THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE ACCESSION OF ELECTRICAL ENGINEERS TO PARLIAMENT.

SOME months ago a leading article appeared in this journal wherein the view was expressed that there was room for more electrical engineers in Parliament. Since that date there have been two by-elections, in which gentlemen connected with the electrical world have played a prominent and a successful part. Mr. J. C. Denison-Pender, the member for the Newmarket Division of Cambridgeshire, is well known to those who are interested in submarine cables. Mr. G. C. Hamilton, M.P. for the Altrincham Division, served an apprenticeship with Messrs. Scott & Mountain, to become, in later years, a director of Messrs. Drake and Gorham.

Here, then, be two members of Parliament whose intimate acquaintance with matters electrical renders them eminently qualified for a seat in the legislature—apart altogether from political attainments. In the same connection mention may properly be made of Mr. George Balfour, a member of the firm of Balfour, Beatty & Co., who are engaged in tramway and electrical undertakings. But for certain happenings which were recently brought to light in the case of "Balfour *v.* Tillett and others," we might have been able to add his name to the list of electrical M.P.'s. He stood for Govan in the election of December, 1911. The night before the poll, at a time when there was no possibility of his taking steps to refute it, a rumour was spread abroad that Mr. Balfour, as managing director of the Llanelly Tramways, had refused to recognise the men's Union. He lost the election, and brought an action for libel against Mr. Ben Tillett and the *Daily Record*—a Glasgow paper. Before it was heard out, the defendants paid £1,000 and costs in settlement, and apologised. Seeing that nine-tenths of the electors were working men, it is but fair to assume that the libel had some considerable effect on the election, although it was not contended at the trial that it actually cost Mr. Balfour the seat.

It is satisfactory to note that, since our article appeared, two members of a great profession have been summoned to the great Council of the State. Were we to attribute this result to any effort of our own, we might incur the censure of him who, when speaking of the conceit of a young man, said: "He is as shy as a newspaper when speaking of its own merits!" No; the satisfactory feature of this new departure is that it is a sign of the times. Parliaments, like the races of mankind, progress and develop by slow degrees. That progress, although slow, is sure. One hundred years ago the Lower Chamber consisted almost entirely of landowners and lawyers. Either it had not occurred to the man of business to enter Parliament, or it had occurred to those who were in possession to do everything that was possible to keep him out. As for your Labour Member, he had not even been born or thought of

But look at the House of Commons of to-day! It contains representatives of nearly every class, creed, and business in the United Kingdom. The process of evolution has been slow, but it is by no means complete. The labour movement which commenced and developed in the nineteenth century had reached an age equal to the allotted span of human life before it began to make its voice articulate in the Halls of Westminster. Great industries, like great movements, must exist and thrive for many years before their position is thus recognised by the people who have the power of the vote. Moreover, to pass from the industry itself to the men who make and mould it, they, too, have to develop before they acquire the knowledge and the leisure which will enable them to take their places in the Parliamentary fighting line. The head of a great business cannot afford to neglect the routine work of his office unless he has educated a large staff, to whom the performance of much of the detail work can be safely delegated.

The exigencies of contemporary politics make it necessary that those who now seek to represent us in Parliament shall belong to one or other of the great political parties. But knowing, as we do, the type of man who is singled out for leadership in one of the greatest of modern industries, we have no fears on this score. Whether he be Tory or Radical, the special knowledge of the electrical engineer will be at the disposal of the legislature when questions arise which he is well qualified to answer. We are persuaded that he will now and always be an ardent exponent of the doctrine of Rutherford B. Hayes, who wrote: "He serves his party best who serves the country best."

Payments on Account.

It constantly happens that in the carrying out of large works it becomes necessary to provide for "payment on account" as the work proceeds. An arrangement is accordingly made whereby when a certain part of the work is done, the builder or contractor becomes entitled to a certain percentage of the contract price.

While the chief duty of the engineer in relation to a contract for a large works is to supervise the work of the contractor, it is by no means an unimportant part of his duty to decide, subject to the terms of the contract, how the contractor shall be paid, and whether he is keeping up to time, having regard to all the unforeseen difficulties which arise in the execution of works of any magnitude. It is proposed to consider the legal effect of the certificate by means of which the engineer usually expresses his decision on all these different questions. As a rule, the engineer authorises the contractor to be paid, and otherwise expresses his approval by means of a certificate. To save trouble and to avoid disputes, the contract between the employer and the contractor should provide for a written certificate. Otherwise a mere verbal statement may be sufficient. Thus, to draw a legitimate analogy from a case which concerned the building trade, in Elmes *v.* Burgh Market Co., 1891, a contract provided that: "The contractor shall receive payment for his contract at the rate of £80 per cent. for the works completed on the surveyor's certificate of completion and the balance at the end of the term of maintenance, less deductions that may be made in accordance with the terms of the contract and on the surveyor certifying that the whole works are in a complete and satisfactory state." It was held that a certificate within the meaning of this clause might be given orally by the surveyor. Where a written certificate is expressly required the contractor is helpless unless it be forthcoming. He cannot sue the employer for the price of any portion of the work which he has done unless he can show that the certificate has been withheld by the engineer acting in collusion with the employer, subject to adjustment or re-adjustment at the end of the contract. The mere fact, therefore, that the engineer, by granting a progress certificate during the course of the work, appears to express approval of that which is already done, will not enable the contractor to sue for payment. The "progress certificate" is sometimes termed a "certificate on account." In some forms of Model Conditions sanctioned by the Institution of Electrical Engineers it is specially provided that no such certificate is to prejudice the rights of the purchasers against the contractor or relieve the contractor of his obligations for the due performance of the contract. It is usual to make provision for progress certificates by saying that the contractor shall be entitled, upon the certificates of the engineer, to payments by the employer in accordance with provisions to the following effect:—(1) As the works progress, 80 per cent. upon the contract value of the work from time to time delivered or executed on the site to the satisfaction of the engineer; (2) the remaining 20 per cent. (usually termed the retention money) in respect of each district section or part of the works as follows:—(*a*) 10 per cent. at the expiration of one month after the employer takes over the works, and (*b*) 10 per cent. at the expiration of nine months after the first 10 per cent. becomes due under (*a*). Payments made under the former provision are made on "progress certificates." To avoid any chance of misunderstanding as to the effect of these documents, it is often wise to insert a clause providing that the certificates given during the work shall not in any way prejudice the employer in the final settlement of accounts, in case it should appear that the contractor has been paid too much.

Postal Electricians in Australia.

It is becoming so usual a thing in Australia for the wages of different classes of workers to be regulated by the State, that it is no surprise to find, from a recent issue of an Australian paper, that postal electricians have applied for, and obtained, a State award. Under the Arbitration (Public Service) Act of 1911, it is not necessary for any inter-State dispute to arise before a claim may be made, and it was, therefore, only necessary for the Postal Electricians' Union to formulate its wishes to ensure consideration under the Act. The case was heard by the President of the Federal Arbitration Court, Mr. Justice Higgins. The award does not extend to either telegraph or telephone operators, but only to linemen, battery men, mechanics, overseers, inspectors, and those engaged in the mechanical department of the telegraph and telephone branches of the Post and Telegraph Department. Some of the claims that were made were rejected on the ground that they involved the transfer of responsibility for administration from the present responsible heads. The Judge declined to dictate a system of management or administration to the Department. He also declined to allow first-class railway fares for journeys over 100 miles, or to insist upon a seven-hour shift in cases where continuous work was necessary.

He pointed out how rapidly the work of the Department had increased in recent years. In New South Wales there were on December 31st, 1900, 45 telephone exchanges, 8,755 lines connected, and 12,197 instruments. Eleven years later, there were 353 exchanges, 34,551 lines connected, and 41,954 instruments in use.

Mr. Justice Higgins protested against reckless liberality as conducive to unrest and dissatisfaction in other branches of the service and kindred industries. He then referred to the rates paid in London and the provinces, and remarked that 7s. here would buy as much of a worker's necessaries as 10s. would in Australia. This is a useful comparison to bear in mind.

The award gives the following minimum rates of pay to employés of the department, who are members of the Postal Electricians' Union :—

Telegraph or telephone mechanics, £168 per year ; senior mechanics, £198 ; foreman mechanics, including foreman mechanics in electric light and power, £208 ; exchange foreman mechanic, £228 ; telephone inspectors, £228 ; mechanicians, Hobart or Perth, £264 ; Adelaide, £300 ; Brisbane, £312 ; Sydney, £324 ; Melbourne, £324 ; cadets, mechanics, or junior mechanics, 14 to 15 years of age, £39 ; 15 to 16, £52 ; 16 to 17, £65 ; 17 to 18, £78 ; 18 to 19, £91 ; 19 to 20, £104 ; 20 to 21, £126 ; 21 to 22, £140 ; 22 and upwards, £156 ; batterymen, £133 ; foreman batterymen, £186.

It was also awarded that provided it was previously decided that work had been satisfactorily performed, mechanics, senior mechanics, batterymen and foreman batterymen should receive three annual increments of £6 each, and other classes should be entitled to scheduled increases at scheduled times as the Commissioner might determine.

Except in the case of shifts, a week's work was to consist of 44 hours. Overtime to be paid at the rate of time and a half for the first five hours, and double time thereafter. Sunday duty time and a half, holiday duty double time. When shifts are worked, eight hours, including one hour for meals, to be the limit, no shift to be commenced later than 11 p.m.

Holidays to a total of 18 days each year, exclusive of Sundays and public holidays, to be allowed.

Whenever one officer temporarily takes the place of another who receives lower pay than himself, he must not suffer any reduction in pay, and if he relieves one of higher status he shall, after one month's service in the higher grade, be paid the higher rate.

A cadet mechanic is to become a junior mechanic after two years' service, or on attaining the age of 18. Every cadet or junior mechanic who attends classes, or joins classes conducted by correspondence, shall be entitled on the recommendation of his superior officer to a payment of half the fees as they fall due, and of the remainder on his passing the prescribed examination for a mechanic.

Other clauses in the award permit of the wearing of a badge of membership in the Union during working hours—a right evidently much prized in Australia—and permission for the Union to display notices on business premises.

These provisions seem decidedly more moderate in tone and temper than those given in other cases where electrical workers are concerned. They only become operative 30 days after being laid before the Federal Parliament. A motion in Parliament is necessary to vary the terms of the award.

The rates of pay seem high for the class of work to be performed, but, as stated by the Judge, the purchasing power of money is less in Australia than here. As the service is a public one, it really means that the revenue of the department must be so arranged that these rates of wages are feasible. In the end, the public pays. Up to a certain point, the gain in efficiency due to just conditions of labour warrants, even in an economic sense, the increase in working expenses ; but there is a point—and that point is for the Judge in such disputes as this to find—beyond which increased working expenses bring no increase of efficiency and only result in making increased charges to the public necessary.

The provision as to help to young workers in the matter of technical class fees is, in our opinion, very good, helpful to the worker and economical to the employer. It is, to a certain extent, done in this country, but there is still room for its more general adoption. The National Telephone Co. gave a good lead to our own Post Office in this respect.

Where Are the Honours?

WERE we to come down to breakfast on one of His Majesty's Birthdays, or on the morning of one of those other auspicious occasions when Honours are announced, and discover that those in authority had actually awakened to the real merit of electrical and other engineering men and scientists, we should fancy that we were still under the influence of the visions of the night. As it is we have no need to "pinch" ourselves to find out if we are awake, for after scanning the latest list very closely, we are moved by the same old impulse to "punch" somebody editorially, which means that this Government, and those associated with it in meting out national awards, have been by vaccination, or in some other way, made immune to all engineering and electrical infections. Maybe the Government is sick with Marconi malaise or telephonitis, and does not desire to encourage those associated with these matters in any way. We regard as little short of scandalous the omission of a number of names of electrical men who have rendered signal service to the nation, and whose honours are long overdue. Of course, we are grateful for such recognition as we find of men who have thoroughly deserved it in departments allied to electrical and other such effort. To these our hearty congratulations—but we profoundly wish that there were more of them, and that they were electrical leaders. These are the names that we select from the list announced on Tuesday last :—

Privy Councillor : Sir Alfred Mond, Bart., M.P., managing director of Brunner, Mond & Co., Ltd.

Baronet : Archibald Denny, Esq. (a past president of the Junior Institution of Engineers).

Knight : Prof. John Harvard Biles, LL.D., assessor at *Titanic* inquiry.

Knight .. Robert Bruce, Esq., C.B., Controller of the London Postal District since 1905.

Knight : Prof. E. A. Schäfer, F.R.S., president of the British Association, Dundee meeting.

Knight : George Henry Smith, Esq., head of the firm of Frederick Smith & Co., Ltd., wire manufacturers, Halifax and Salford.

C.B. : Mervyn O'Gorman, Esq., Superintendent of the Royal Aircraft Factory.

Imperial Service Order : C. P. O'Rielly, Esq., Indian Telegraph Department, Deputy Superintendent and Honorary Assistant Superintendent, Allahabad.

Municipal Parsimony.

A REPORT in the *Irish Times* of June 3rd of a meeting of the Dublin Corporation reveals a mental attitude on the part of some of the members which does no credit to their intelligence, though it may throw some light on the subject of the inadequate salaries of engineers in municipal employ. The revision of the scale of salaries paid to the shift engineers and switchboard attendants of the Electricity Department was under consideration, when a Mr. Partridge proposed that the matter be adjourned until the case of the working men, who taught the shift engineers and switchboard attendants their business, was considered. He said he did not think very highly of electrical engineers, as, in his opinion, it was a profession adopted by men who wanted to draw wages without doing any work.

This egregious deliverance was greeted with laughter ; tears would have been more appropriate. The Lord Mayor, who evidently is better acquainted with the facts, said he thought engineers and switchboard attendants should get at least £156 and £104 respectively—it was only a clerk's wages. The question was adjourned for further consideration, and it is to be hoped that in the meantime steps will be taken to enlighten the members of the Council as to the duties and qualifications of their technical staff.

A report on the revision of the salaries of the higher officials of the department was also considered. A Mr. Cosgrave said the rates had subsidised the concern to the extent of £45,000, and the ratepayers ought at least to get back their money before the salaries of these officers were increased. Could anything be more paltry? How can the Corporation hope to see the business making a profit unless it employs, and pays, the best men to control it? The aggregate salaries of the three officers concerned amounted to £1,500, and the capital invested in the undertaking is £750,000 ; the salaries, therefore, represent 0·2 per cent. on the capital value—and the three recipients are to be penalised until a profit equal to 30 years' salaries has been made by the department. The consideration of this report was adjourned for six months. Clearly it is high time that steps were taken to protect the interests of station engineers. The Association of Electrical Station Engineers may well direct its attention to the first case mentioned above, but cannot deal with the second ; however, a new association is in embryo, as will be gathered from our "Correspondence" columns to-day, and if it is formed we hope it will prove effective in raising the status of engineers in the eyes of the public.

The extraordinary views of the municipal man were further illustrated in the course of the same discussion, when a Mr. Beattie stated that in 19 years the ratepayers had got only £9,000 back out of the £750,000 they had invested in the electric undertaking. "*They had invested*"—cannot these gentlemen realise that the ratepayers have not invested one penny in the undertaking beyond the £45,000 derived from the rates? Meum and tuum seem to have lost their meaning in Dublin.

THE INSTITUTION OF ELECTRICAL ENGINEERS IN PARIS.

(*Continued from page* 883.)

During the visit the six aerial antennae attached to the top of the Tower were heard at work, emitting a crackling sound. On descending, the visitors heartily applauded a brief speech addressed to M. Eiffel by M. Berthelot, expressing their appreciation of his kindness in affording them the opportunity to visit his masterpiece under such agreeable conditions. Many of the party then proceeded to the underground wireless installation controlled by M. le Commandant Ferrié, which

Cliché du Vérascope Richard.
The Party Leaving Versailles.

is situated a few hundred yards from the Tower, and was not easily found by some of the visitors—for even when the pit through which the connection to the aerial is taken has been located, the entrance to the extensive subterranean department remains to be discovered, and at least one gentleman, to our knowledge, only attained this end when he saw the other visitors coming out of the ground. To attempt to describe the equipment of the station in detail in the space here available would be a hopeless task; but we may say that the apparatus works on the "spark" system, with generating plant of about 50 kw., and in order to increase the range and strength of the signals a 100-kw. set is now being installed.

It will be remembered that the Eiffel Tower station maintained communication throughout the campaign

Photo by B. Thomas.
Tea at the Trianon.

in Morocco, in 1908, with the cruiser Kléber, which was stationed at Casablanca; thanks to the great height of the antenna, a power of 10 kilowatts sufficed for this purpose. The success thus achieved led to the development of the station on a permanent basis; progress was delayed by the flood in 1910, which burst an old drain beneath the underground chambers and flooded the station. The present equipment comprises three sets of transmitting apparatus, namely, the original 10 kw. plant, which is still used for moderate distances; a 40-kw. set, with Moscicki condensers of 0.7 mfd. capacity and a spark-gap which originally consisted of zinc cylinders 25 cm. in diameter × 50 cm. long, revolving 4 times per second; and a 10 kw. set with a musical spark, fed with alternating current at 600 cycles per second by a Bethenod alternator, with a spark-gap consisting of a brass tube 50 mm. in diameter and 1 mm. thick, having its axis at right angles to a flat copper disk. A blast of air is driven through the tube to blow out the sparks and keep the parts cool. With this type of spark-gap pure and regular tones are obtained, and it needs no adjustment except regulation of the gap. Signals sent by this equipment, using less than 10 kw. at the terminals of the alternator, have been received by the Marconi station at Glace Bay during the night. The success of the tube-and-disk gap led to its adoption for the 40-kw. set, using a brass tube 20 cm. in diameter and 1 cm. thick, with a copper plate 65 cm. in diameter and 2 cm. thick. The spark in this case is 15 mm. in length, and the current in the antenna has reached 60 amperes.

The antenna consists of 6 steel cables, suspended from the top of the Tower and attached at the lower ends to pillars concealed in shrubbery; the middle portions of the cables are effectively insulated from the ends, and are connected together at their lower limits and joined to a single cable dropping vertically into the station. Abundant provision of receiving apparatus is made, and the equipment also comprises all that is

Cliché du Vérascope Richard.
At the Aerodrome, Buc; M. Bleriot in Centre.

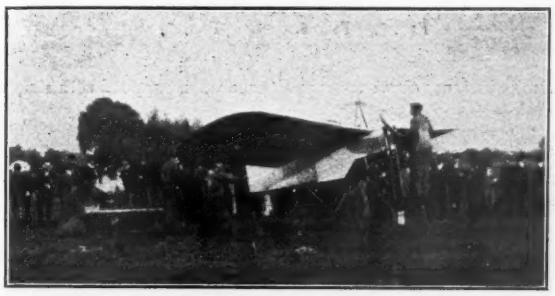
necessary for the conduct of investigations into all branches of wireless telegraphy.

Laboratory accommodation is provided for testing wireless apparatus of all kinds, and a large number of military, marine, and other sets manufactured by the three French wireless companies, were shown in operation. The spark-gap belonging to the "musical" installation for distributing time signals, meteorological and other information of value to navigators and other professional men, was set at work in the presence of the visitors, the sparks sounding like pistol shots. The enthusiasm manifested by M. Ferrié in demonstrating the capabilities of this important station—the official international centre for the distribution of time—was excelled only by the courtesy and good-nature with which he answered questions and explained apparatus, while his staff zealously followed his example.

On Friday morning Mr. Duddell presided at the meeting of the Congress, which was devoted entirely to the subject of electric traction on railways, continuing the discussion which was commenced on Wednesday. Amongst those who took part in the discussion were

Messrs. Thury, Gratzmuller, Latour, Slingo, Mazen, Girousse and Parodi. Mr. Slingo pointed out that in England the telegraphs were more liable to interference owing to the high speed at which our circuits were worked. The adoption of the central battery system for the telegraphs in London had overcome the trouble, thanks to the higher resistance and higher voltage employed, which swamped the stray currents. Alternating current harmonics gave trouble, even on perfectly erected looped overhead telephone lines.

In the afternoon a special train, provided by the courtesy of the Chemin de Fer du Nord, conveyed a large party—some 230 in number—to Chantilly, whence they drove in brakes through leafy avenues to the famous Château. They were conducted through



Bleriot Aeroplane about to Start.

the Musée Condé by the curator, M. Berger, and were charmed with the exquisite works of art which it contained, as well as by the splendour and beauty of the shell in which these priceless pearls are stored. Some found time for a delightful stroll through the richly-wooded grounds, and afterwards driving through Chantilly, the Newmarket of France, the party rendezvoused at the Hôtel du Grand Condé for tea before returning to the city.

Saturday morning at the Congress certainly provided the most interesting and varied programme of the week; Mr. Duddell again presided, and first M. G. Claude delivered a lecture on lighting with vapour tube lamps, a subject of which he is a master, and which he handled with inimitable grace and humour. After referring to the discovery of neon and the other rare gases of the atmosphere by Sir William Ramsay, M. Claude explained that he had succeeded in devising means of producing neon on a commercial scale; the gas was particularly suitable for use in electric lighting, owing to its low resistance to the electric discharge—neon only requiring 13 volts where air required 1,000 volts, to cause the discharge to pass.

Unfortunately, the spectrum of neon is practically devoid of blue rays, the colour of the light being a rich reddish orange, and the gas is extremely sensitive to impurities, which are given off by the electrodes. The latter are also apt to volatilise. However, by using large electrodes, and absorbing the impurities with charcoal cooled by liquid air, M. Claude has succeeded in increasing the life of the neon tube beyond that of incandescent lamps. The voltage required by the neon tube is one-third that of the Moore vapour tube lamp, and the candle-power per metre is 200 c.p. as compared with 60, the efficiency being 0.6 watt per candle against 1.7. The light is physiologically excellent, and increases visual acuity by 25 per cent.

By using mercury vapour lamps alongside of neon tubes the excess of red and deficiency of blue rays can be corrected; M. Claude has applied this correction by placing some mercury in an ordinary neon tube, which then gives the mercury vapour spectrum. When the correcting tube is used together with the ordinary neon tube, the result is an excellent white illumination giving colours in their true tints, with an overall efficiency of 0.8 to 0.9 watt per candle. These facts were admirably demonstrated by a series of experiments, which were completely successful and were extremely effective in driving home the different points made by the lecturer.

On the other hand, for some purposes, such as advertising signs, the orange-red light of the neon tube alone is most effective; with the aid of his colleague, M. de Beaufort, M. Claude has made neon tubes of small diameter in the form of letters, etc., with striking effect, and some of the theatres in Paris employ the neon tube over their entrances, rendering them conspicuous at a great distance.

Next Mr. Slingo read a paper on methods recently introduced into the British telephone exchanges for automatically facilitating manual operating, by distributing traffic evenly over a number of operators' positions, improving the transmission conditions where several call-wires terminate on one "B" position, and by automatically selecting and isolating a call-wire when one is required by an "A" operator. The experimental equipment described in the paper was installed for the Post Office by Messrs. Siemens Brothers and Co., Ltd.

M. Charbonnel briefly summarised the communication for the benefit of his colleagues, and Mr. G. H. Nash also took part in the discussion.

Commandant Ferrié followed with a paper on the application of wireless telegraphy to the distribution of time signals, explaining the methods adopted at the Eiffel Tower station for dispatching the signals, and illustrating his remarks in the most effective manner possible—namely, by receiving the signals sent out from the Tower before and at 10.45 a.m., and rendering them audible to the whole audience.

M. Ferrié also explained how the time can be given with an accuracy of 1-100 of a second by the "method of coincidences"—in essence a very old device of English origin, and familiar to the workers in physical laboratories, but new to the bulk of the audience. This was also demonstrated by a very pretty experiment, and it was explained that by this means differences in longitude could be determined with great accuracy, and observatories could obtain from one another "the right time," so as to tide over periods when bad weather rendered astronomical observations impracticable. At the International Conference held in Paris in October last year, the time signals were reorganised, and the Eiffel Tower was designated as the centre of the International time-service. The new system will come into operation on July 1st. It is interesting to note that in communicating time signals between Paris and Washington, a distance of 6,000 km., the time occupied in the transmission of the electric waves has to be taken into account, being of the order of 0.02

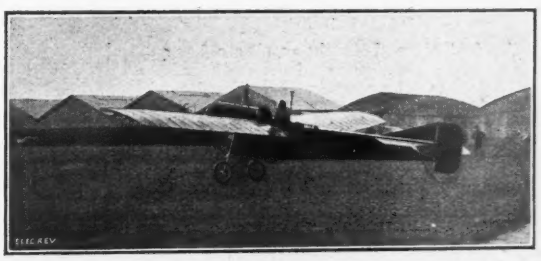


Photo by B. Thomas.

Aeroplane Leaving the Ground.

second, which is not a negligible quantity; it is hoped that this period will shortly be known so accurately that it will be possible to compare the times in Paris and Washington to an accuracy of 1-1,000 of a second.

M. Ferrié's interesting lecture was followed by a brief discussion, in which Messrs. Turpain and Abraham took part.

In the afternoon the members of the two Societies, with many ladies, forming a party of about 300, were conveyed in motor-omnibuses to Versailles, where they visited the Palace and, as at Chantilly, were charmed with its magnificence and the beauty of its contents. They partook of tea and light refreshments at the Trianon Palace Hotel, and here Mr. Duddell took the opportunity of expressing the gratitude of the British visitors to their hosts, and in particular the thanks of

the visiting ladies to the French Committee of ladies, headed by Madame Grosselin, who had provided so abundantly for their entertainment. M. Berthelot responded, and toasted the lady guests with a cup of tea, in the absence of a more appropriate fluid. We may remark that the thoughtfulness of our French confrères in providing tea on many occasions, often in addition to the products for which their country is justly famed, was much appreciated by many of the visitors.

From Versailles the party proceeded to the Aerodromes at Buc, where they were received by Colonel Renard, and first inspected the establishment of M. Blériot, who also welcomed the guests. A large number of Blériot aeroplanes were marshalled on the flying-ground, and ascended one after another with an ease and certainty that left nothing to be desired. The Government flying-ground was also visited, and various machines—Farman, Esnault-Pelterie, etc.—went up in succession. Often there were seven or eight aeroplanes in the air simultaneously, and the daring evolutions which they performed thrilled the spectators.

It is interesting to note that M. Berthelot himself was one of the first to acquire the title of "aviator"; but unfortunately he was too modest to favour the visitors with an exhibition of his skill.

Finally, the motor-'buses conveyed the party to the Gare de Versailles, where they were received by M. Claveille, director-general of the State Railways, and Messrs. Mazen and Foucault briefly explained to them the construction of the new electric coaches, in which they returned to Paris. This concluded a meeting which was full of varied interest and will long dwell in the memories of the British visitors as a most enjoyable and successful occasion.

We are indebted to M. Perrin, director of the firm of Messrs. Richard Frères, for several of the photographs which we have reproduced in the course of this article, and to the kindness of our confrères of *La Lumière Electrique*, as well as of many other friends, for innumerable courtesies rendered to us during the visit.

(Abstracts of Papers discussed in Paris at the Joint Meeting of the Institution of Electrical Engineers *and the* Societe Internationale des Electriciens, *21st-24th May*, 1913.)

(*Continued from page* 883.)

Single-Phase Traction.

By Monsieur Marius Latour.

In the first place the author makes a few general observations in regard to the mechanical construction of single-phase locomotives and to the erection of overhead conductors.

The tests carried out by the Compagnie du Midi have been very interesting, because every type of motor has been tried.

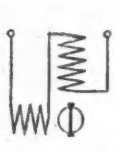


Fig. 1.

Fig. 2.

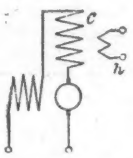


Fig. 3.

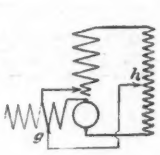


Fig. 4.

The motors experimented with, excluding the well-known Westinghouse series type, have been: (1) the simple repulsion motor (Brown, Boveri) and the compensated repulsion motor (A.E.G.); (2) the series motor with a transverse local field for compensating the electro-motive force of short-circuit under the brushes (Jeumont) and the series motor with an elliptical field (French Thomson-Houston Company).

The simple repulsion motor is shown in Fig. 1. As the present author has shown, there is found in the repulsion motor, due to the current produced in the short-circuited coil by its rotation, a transverse field which interacts with the main field so as to give a synchronously rotating field, thus ensuring satisfactory commutation at that speed. This simple observation, which previous authors have overlooked, has settled the future of the repulsion motors.

At speeds above synchronism, however, the transverse field increases in strength, the commutation becomes unsatisfactory, the iron losses increase, and at speeds above $\sqrt{2}$ times synchronous speed the commutation of the repulsion motor becomes worse than that of the series motor.

I have given the name compensated repulsion motor to the motor shown in Fig. 2. This motor has the essential characteristics of an ordinary repulsion motor. It has, moreover, the advantage of working at approximately unity power factor, due to the property of commutator motors with short-circuited brushes having no inductance at synchronous speed and negative inductance above that speed, even when supplied with simple alternating current.

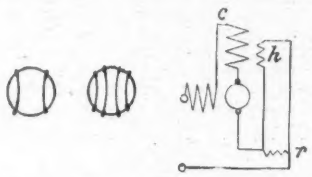


Fig. 5. Fig. 6. Fig. 7.

A series motor with an artificial transverse field which neutralises the electromotive force of short-circuit as happens naturally in repulsion motors at synchronism, is shown in Fig. 3. The winding h can be connected in shunt to the terminals of the motor. If it is assumed that the compensation in the motor is provided so as to ensure perfect commutation with continuous current, it is clear that the winding h should carry a current 90 degrees out of phase with the main current. But the winding h can be allowed to assist compensation, and in this case such winding, in addition to the current which is 90 degrees out of phase, will carry a current in phase with the main current. If, on the other hand, over-compensation takes place with the winding C, the winding h will carry a current opposed to the main current.

I have given the name elliptical field motor to the motor arranged as shown in Fig. 4. A short-circuit is established between the point g of the exciting winding, which can be extended for this purpose, and the point h of the transformer supplying the motor. Apart from the ordinary compensation, which would give good commutation in the case of continuous current, a local strengthening of the field can be provided, as is shown in Fig. 4; it follows that the point g should not be so far removed from the rotor.

By rubbing surface we mean the contact area of the brushes on the commutator. The reduction in the contact surface is the important feature in alternating-current machines provided with a commutator. It is easily shown that the losses on the commutator are a minimum when the losses due to the current are equal to the losses due to the short-circuit currents.

Theory shows the decided advantage of a high peripheral speed for the commutator. To obtain the high peripheral speed a high-speed motor should be used. But high speed requires the introduction of gearing. This is the feature of the Jeumont and Westinghouse locomotives, as well as of the Oerlikon locomotive at Lötschberg. Gearing appears to give entire satisfaction from the mechanical point of view.

High speed is not in principle incompatible with any type of repulsion or series motor. But it so happens that in the case of the repulsion motor, where the number of poles is determined by the number of conductors, a frequency of 15 leads to a motor with a small number of poles.

It would seem to be difficult to obtain a pressure between the segments low enough for large powers, but the arrangement of having two short-circuits has been suggested (see Fig. 5), in which the brushes would be placed in a position where the pressure between the segments is still lower; and I have also suggested the use of independent overlapping windings, and especially the arrangement of two overlapping windings with two commutators.

A doubt may arise whether it is possible to arrange for a sufficient number of sets of brushes to carry the current. My arrangement of multiple brushes (see Fig. 6) would, however, at the same time do away with this difficulty.

The bad commutation of repulsion motors is often wrongly attributed to over-synchronism. Faulty compensation is alone responsible in such cases.

The inferiority of the repulsion type of motor at a frequency of 15 appears to lie in its weight, and indirectly in its lower efficiency. In consequence of the smaller number of poles, the repulsion motor requires a greater amount of iron; a larger external diameter is necessary, or, on the other hand, for a given external diameter a smaller bore has to be used, thus leading to a less advantageous utilisation of the material.

Whatever may be the frequency the efficiency of the repulsion motor remains in principle identical with that of a single-phase alternator of the same frequency, whilst the efficiency of a series motor tends at lower frequencies towards that of a continuous-current machine. The difference in efficiency between the two types of motor is thus appreciable at a frequency of 15.

The transverse field which is 90 degrees out of phase, and is required to neutralise the short-circuit electromotive force varies directly as the current and inversely as the speed. Supposing the excitation is provided by constant current, the resultant field of commutation is a function of the speed.

All the types of motors to which we have referred above, even the series motor of which the auxiliary pole is in shunt with the

terminals, possess, so long as their circuits are not modified, a transverse field 90 degrees out of phase, which increases linearly. Accordingly, the electromotive force of short circuit can only be neutralised satisfactorily for a certain speed. It is therefore quite natural to think of adjusting the transverse field according to the speed. These adjustments can be carried out by a centrifugal governor, or by an electrico-dynamical speed device. Complications, however, arise in this respect.

It should be noticed that the presence of true commutating poles in repulsion motors detracts from the simplicity of their construction and connections as compared with the series motor. If simple arrangements could be fitted so as to ensure a transverse field suitable for all speeds and for effecting satisfactory commutation, such arrangements would then be preferable. With the winding h of Fig. 3 connected across the terminals of a resistance r through which the principal current of the motor flows (see Fig. 7), it is seen at once that the transverse field will be proportional only to the current, and will be independent of the speed. In other words, with variable speed, the commutation of a polyphase series motor is substituted for that of a repulsion motor.

Whilst the use of a resistance may be practicable at 15 periods, it may be expected to be inadmissible at 25 periods.

In order to reduce the losses in the resistance it is convenient, a low frequency and narrow auxiliary poles having been chosen, to work with reduced air-gaps, high speeds, and a large number of poles. At a frequency of 15 periods these losses can be reduced to the negligible value of $\frac{1}{3}$ or $\frac{1}{4}$ of 1 per cent.

The Electrification of the State Railway: The Paris Suburban Lines.

By Monsieur A. N. Mazen.

The State railway system, formerly the Ouest lines, serves a very considerable portion of suburban Paris. The lines of this system, which end at three termini, comprise at present a total length in this section of about 500 km. of single track. This total will be increased to 800 km. in a few years' time. A huge traffic naturally corresponds with such a large development of track. From the point of view of the number of outward and inward travellers, the St. Lazare station is by far the most important, not only of the Paris but of European stations. Only Liverpool Street Station in London is at all to be compared with it.

In addition the State railway organisation has to suffice for its main-line service; the system, with its 9,000 km. of track, brings daily from the ten principal extremities more than 80 train loads of passengers into the capital by the main lines. If to these the number of suburban trains are added, a total of more than 820 train-loads entering Paris daily is obtained, which, with the outward trains, amounts to a total of more than 1,640 trains (in and out) in the 24 hours, and as the day is made up of 1,440 minutes, this corresponds to more than a train per minute entering or leaving Paris.

The number of passengers who annually make use of the three State railway termini of Paris amounts to about 70 millions. Of this total the St. Lazare station alone accounts for about 60 millions; and the annual increase is of the order of 2 millions. The permanent way and everything connected with it must be utilised to its maximum capacity. At present the service is only made possible by using coaches with roof seats, which increase the capacity of the trains, but could not be retained in a modern scheme.

The most difficult sections to work are those in which trains having very different speeds (expresses, fast trains, local, and goods trains) are run on the same track. The traffic congestion does not allow of a very good service for the different suburban sections, and the speeds obtained are, in almost every case, insufficient. For the local trains a speed of 25 km. per hour (a speed scarcely greater than that of the Métropolitain, 20 km. per hour) can alone be assured; by the fast locals and fast trains from 35 to 45 km. per hour.

The amount of rolling stock employed in the suburban service is very considerable, in spite of the comparatively small number of trains per hour. It comprises about 1,500 coaches and 200 locomotives which represent, together with the necessary workshops and sheds, a total capital expenditure of more than 50 million francs. The utilisation of the seating capacity does not exceed 18 to 20 per cent., and the weight moved is obviously very great (1,500 million ton-kilometres per year). The final outcome from the financial point of view is a large deficit, which will go on increasing unless stringent measures are taken for improving the service as a whole, while providing for a great increase in traffic.

At a terminus the necessity of making two, three, or four movements for every train coming in or going out blocks the exit roads and undoubtedly increases the chances of accident. To increase the capacity of the terminus and its platforms, it is absolutely necessary to decrease the number of these movements by preventing the transfer of the locomotive from the back to the front of the train, by equipping the train in such a manner that it can be driven either from the front or from the rear.

With electric traction all requirements are satisfied. The system of multiple-unit control allows of all the electric motors driving the axles of the train to be worked from either end. Further, by distributing the electric motors among the different carriages of the train a large adhesive weight is available allowing rapid acceleration, which permits of the trains getting away quickly from the platforms, increasing their capacity.

The considerable experience obtained in the use of steam traction shows that it is useless to try to exceed a maximum of 10,000 to 12,000 passengers per hour with carriages without top seats, on a two-track line with frequent stops. With electric traction, with carriages 3 m. wide, and 22 m. long, and assuming eight carriages per train, the enormous figure of 40,000 passengers per hour is reached, or, considering seats only (no standing), that of 20,000 passengers per hour.

The conclusion is therefore arrived at that electric traction, with its rapid acceleration, allows of the time taken on the journey being so diminished as to double the capacity of the line. It moreover eliminates train movements and reduces the number of platforms at the termini necessary for a given service.

To obtain the preceding figures it must clearly be understood that each section of the line under consideration would be used only by suburban trains running at the same speed. This implies that trains of different speeds shall travel on separate tracks.

No section of a steam line can deal with more than 100 trains in each direction per day, whilst it is agreed that on electrified lines this figure may reach 350.

The electrified line from the Invalides to Versailles has shown traffic increases of 12 to 13 per cent. per year, while the other steam lines showed increases of barely 2 or 3 per cent.

A single type of electric carriage has been adopted, consisting of guard's van and first and second class compartments. This coach can carry 100, including straphangers. During much of the time the service will be carried on by single-coach trains, the number of seats being amply sufficient at such hours. During the time of heavier traffic and on the more busy sections the trains will be composed of several similar coaches.

The Nord-Sud has successfully employed continuous current on the three-wire system, using as conductors an overhead wire and a third rail, each at 600 volts, the track rails serving as a neutral wire. A system has thus been evolved which by suppressing the return current and its drop in pressure is completely innocuous, so far as electrolysis is concerned. The three-phase system hardly lends itself to rapid acceleration, and is useless for multiple-unit working. The other systems only employ two conductors, one of which is, in almost every case, the track rail. The single-phase system permits the use of high voltages on the working conductor; it is therefore possible to use a light overhead wire. The continuous-current system, if normal pressures of 500 to 700 volts are used, is only available with a heavy steel conductor about ground level.

With the single-phase system there is a considerable simplification in distribution from the use of static transformers in place of sub-stations with rotary converters; there is also a saving in the number of attendants, better efficiency, and freedom from electrolysis troubles. With the continuous-current system, the equipment of the coaches is much lighter and less cumbersome, the acceleration more rapid, with a better efficiency of the motors, and lastly, less waste of energy per useful ton carried.

In numerous recent railway investigations for particularly heavy traffic, the continuous-current system has shown a real superiority to the single-phase on the economic side. The stationary installations are cheaper for single-phase than for continuous-current (sub-stations and tracks). On the other hand, the equipment of the rolling stock is both heavier and more costly. The heavier the traffic the greater the advantage of the continuous-current system. It is the same with the working expenses, the more the installation is utilised, the lower is the expense per ton carried by the continuous-current system as compared with the single-phase system, chiefly owing to the weight of the equipments.

As regards the single-phase system, it is necessary to include the difficulties caused to telegraph and telephone transmission, which are not yet overcome. For all these reasons, and particularly since on most of the sections the density of the traffic is already very high and is bound to increase, the State railways, being anxious to make no mistake, have adopted the continuous-current system at 650 volts. This system is sanctioned by long usage, it is thoroughly reliable, and in the present instance it is certainly the cheapest. Everything that exists in Paris in the way of heavy electric traction is worked with continuous current at 650 volts.

To avoid trouble from frost after a thaw, a conductor rail with under collection was proposed. This rail weighs 76 kg. per metre. It is carried by supports of impregnated wood. The motor-coaches collect the current by a special shoe, called "universal," arranged so as to collect either from the upper or under surface of the rail.

The sub-stations, placed wherever possible at junctions, contain rotary converters of 1,500, 1,000, and 750 kw. output, according to their importance. Their distance apart varies from 3 to 8 km., according to the density of the traffic. The sub-stations are supplied by three-phase underground cables at 15,000 volts, 25 cycles. Electric energy will be furnished by two power stations, the construction and working of which has just been entrusted, after public tender, to an industrial syndicate. There is a sliding scale of charges under which, when the stations are finished, electric energy will be sold to the State at an inclusive charge of about 5 centimes per kilowatt-hour.

The two power stations, comprising steam turbine units of 5,000 kw., will be placed at Moulineux and at Bezons on the banks of the Seine. When the installations are complete, they will have a capacity of about 60,000 kw., and will furnish the State with about a hundred million kw.-hours per annum.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Mutual Protection of Engineers.

I observe with pleasure that our engineers are, at last, appealing for mutual protection. Is it not an uncomplimentary reflection on modern times that they, the greatest race of men the world has ever known, should have to do so?

If you could kindly allow a digression, I would take the liberty of reminding you that Alexander the Great made the following list of the Seven Wonders of the World:—The Pyramids of Egypt; the Hanging Gardens of Babylon; the Tomb of Mausolos; the Colossus of Rhodes; the Statue of Zeus by Phidias; the Lighthouse on the Island of Pharos; and the Temple of Diana. But Alexander the Great was not even an engineer. What has happened to his treasures?

Of the first, there is no authentic record as to whom they were erected by. With the second, after a decade, the worms and the weeds had their way. The creation of the third was too exquisite—too precious to last. In the age of Cæsar the fourth was but a memory; and though it was of marble, inlaid with gold, ivory and ebony, the Romans tumbled the fifth from its pedestal, and carried it away *en bloc*. Nor has the sixth met with better fortune; whilst even in the time of Paul, the material of the seventh was used for houses and barns by anyone who cared to appropriate it.

These Seven Wonders of the World were things of pride and pomp, constructed to glorify and to amuse the few. Discord and misery and death for the many were the results of the proud plans of their making.

But to-day, if one asked the engineer to make a list of the Seven Wonders of the World, he would probably mention:—The turbo-generator; the ocean liner; the motor-car; the rotary printing machine; the telephone; the tram-car; and the modern express.

These things minister to all the people. They influence the lives of every sane and efficient person. They serve us daily. Unlike the Seven Wonders of Alexander, none are for the exclusive few. All represent inventions, not merely individual things. They can never die, because they are founded on the ideas of a race of engineers, and are self-duplicating.

The principles for which they stand sprang from the brains of the engineers, and now these principles are the priceless heritage of the living world. Other men may die and turn to dust, but the record of our engineering dreams, once made tangible, remains.

An Association for the Mutual Protection of Engineers is long overdue.

M.Sc.

May 31st, 1913.

[Our correspondent appears to be comparing incommensurables—monumental works with inventions; the former were individual constructions, each of which was unique, while the latter were the fruit of evolution extending over long periods. The Forth Bridge, the Taj Mahal, the Eiffel Tower are examples of the former class, while the wheel, the screw and the mariner's compass are comparable with the latter in importance to mankind, and are of immense antiquity. The modern engineer builds upon the foundations laid by his barbarian forerunners, whose work will endure to the crack of doom.—Eds. E.R.]

It is sincerely to be hoped that the correspondence started in your columns on the above subject will develop into the definite formation of some central organised body to protect the interests of members of manufacturers' engineering staffs. When one considers the atmosphere of oppression under which many of us labour, and one's helplessness to combat the many petty inflictions that are continually imposed on us, one cannot help reproaching oneself that we have collectively been so dilatory. It is truly disappointing that in view of the admirable results of kindred associations (*e.g.*, the various Trade Unions, the British Medical Association, and the Law Society), an association has not yet been formed to preserve the rights and to vindicate the claims of the class of engineers to which I have referred above.

I am afraid that we cannot expect the I.C.E., the I.E.E., or the I.M.E. to champion our cause. These Institutions were formed for the purpose of furthering and promoting the technical aspects of engineering and not of protecting the individual interests of the members. As such, their members are drawn from all classes of engineers; at the Institution meetings, employer and employé fraternise with a genuine unselfish desire to further the interests of the Institution of which they are members. Any action on the part of one of the Institutions to help us now, therefore, would inevitably mean the displeasure and ultimate resignation of the employer members—a course of events which would speedily cause their ruin.

It is obvious, therefore, that we must endeavour to form a new association, something equivalent to, and comparable with, the B.M.A. The function of this association should be solely to regulate conditions of employment, and to deal with allied questions. It should not trespass on the territories of the existing institutions by becoming a technical institution. Neither should it become as academical as these. It should regard itself purely and solely as a means of protecting the interests of staff employés. There must surely be thousands of engineers who would like to see such an association initiated. Now is an opportune time for declaring their views.

Let the opportunity not be missed.

Frank Gill.

[To prevent confusion, we may say that our correspondent is not the well-known telephone engineer of the same name. —Eds. E.R.]

Your correspondents and readers in general may be interested to learn that we hope to submit for publication in your issue of June 13th or 20th definite proposals for the formation of a suitable British Engineering Staff Association. This suggested institution will have as its objective, of course, the maintenance and furtherance of the economic and social interests of engineers—mechanical, civil, electrical, &c. Meanwhile, perhaps those gentlemen who approve of such an Association will kindly give the matter as much publicity as possible.

L. H. Fletcher,

Hon. Acting Secretary, Proposed Association.

London, E.C., *June 2nd*, 1913.

Heavy Capacity Lampholders and Adapters.

Some little time ago through your valuable columns I stated that the above were very much wanted, so that 5—10-ampere radiators and other medium current consuming apparatus could be fed from any lamp socket, &c. At least one manufacturer has met the long-felt want as regards the lampholder, but no one has yet supplied an adapter to carry the same current without heating up, so that the one without the other leaves the problem only half solved.

C. J. Stonier,

Sales Superintendent.

Dundee Electricity Supply,
May 29th, 1913.

Cable Discounts.

The formulæ given on page 894 of the current Electrical Review appear to be unnecessarily elaborate. List price less 27½ per cent., 15 per cent. and 10 per cent. is equal to list price × ·554625. Surely L × ·555 is much more simple than the rather formidable formula given by your correspondent for "C.M.A. £ per mile," and the former gives a result only ·07 per cent. too high, surely near enough for the "most conscientious of contractors"? For estimating ·55 is quite near enough, as the error is less than 1 per cent.

As it happens, 555 and 55 are very simple multipliers to use, and the result may usually be obtained with very little figuring, and very often by inspection only. As $555 = \frac{1110}{2}$, it is evident that 555 multiplied by an *even number* is equal to *half that number repeated three times and followed by* 0, thus :—555 × 4 = 2,220 ; 555 × 6 = 3,330.

555 multiplied by an *odd number* is equal to *half that number, with the sum of the two figures thus obtained repeated twice and inserted between the two figures*, thus :—

555 × 5 = 2,775 ; 555 × 9 = 4,995.

(This is, of course, the same thing as :— $\frac{5550}{2}$ = 2,775 ; $\frac{9990}{2}$ = 4,995.)

If 55 is used, the figure in the case of an even multiplier is repeated *twice* only, and in the case of an odd multiplier, the middle figure is used *once* only, thus :—55 × 4 = 220, 55 × 5 = 275. Though this method may appear at first sight to be rather complicated, it is really very simple. As an example, take a list price of £85 10s. (*i.e.*, £85·5). In this case, if ·555 is used, one would simply write down from inspection,

44·400
2·775
·2775

and obtain the result 47·4525, or £47 9s.

If the list price is, for example, £50, the result, £27·75 or £27 15s., is obtained at once by inspection. For "C.M.A.s. per coil" the formula is L × ·69328125 ; L × ·7 gives a result under 1 per cent. too high.

For "C.M.A.d. per yard" the formula is L × ·0756307 ; L × ·075 gives a result under 1 per cent. too low. In this case, it is most convenient to take three-quarters of the list price and shift the decimal point one to the left. In most cases, the result may be obtained by inspection. Similarly, for "N.A.d. per yard," it is convenient to take two-thirds of the list price and shift the decimal point one to the left.

A note may be kept of the percentage error of each formula, and if one wishes, for a special purpose, to obtain a very close figure, the necessary percentage may be added to or subtracted from the result obtained from the approximate formula.

John W. Black.

Glasgow, *June 2nd*, 1913.

LEGAL.

BALFOUR *v.* TILLETT AND THE GLASGOW "DAILY RECORD."

ON May 29th was concluded, by compromise, in the King's Bench Division, before Mr. Justice Darling and a special jury, an action for damages for alleged libel brought by Mr. George Balfour, managing director of the firm of Balfour, Beatty & Co., the well-known electrical engineers and contractors, against Mr. Ben Tillett, the secretary of the Dockers' Union, and the proprietors of the Glasgow *Daily Record*. The action was a sequel to a strike of tramway men employed by the Llanelly Electric Lighting and Traction Co., in which the plaintiff's firm have the controlling interest, and Mr. Balfour alleged that he was libelled by a statement which appeared in the *Daily Record*, and which was instigated by Mr. Tillett. That gentleman denied the publication, which, however, was admitted by the *Daily Record*, and both defendants pleaded justification, alleging that the statement made was true.

MR. DUKE, K.C. (for the plaintiff) explained that his client regarded the libel as a malicious falsehood, published to injure him when he was candidate for Parliamentary honours in the Conservative cause for the Govan Division of Scotland. It appeared that the plaintiff's firm formed the Llanelly Tramway Co. They had engaged in many large electrical undertakings of that character, and employed on an average about 1,500 men. They were always willing to recognise a Trade Union. When the Llanelly Co. was formed a branch of a Trade Union was commenced among the workmen. On the morning of Mr. Balfour's poll at Govan, in December, 1911, the following appeared in the *Daily Record* :—

"Mr. George Balfour, the Unionist candidate for Govan, is the managing director of the company that governs the tramways of Llanelly. The Dockers' Union asked the company to recognise the Union, so that an endeavour might be made to avert a stoppage, but the company refused to do so. On behalf of the Union Mr. Ben Tillett then wired to Mr. Balfour, asking him to recognise the Union in order to prevent an outbreak, and Mr. Balfour has now instructed his head office to refuse that recognition. A Llanelly telegram says that the strike is causing great inconvenience in the town."

That statement was read by practically nine-tenths of Mr. Balfour's constituents, who were staunch supporters of Trade Unions in general, and the result was that Mr. Balfour felt the power of the Press and the Dockers' Union, and lost his election. A few days afterwards Mr. Tillett, in a conversation he had with Mr. Balfour, without any change having taken place in the relations between the company and the men, said he was willing to get the men back to work. So he (counsel) suggested to the jury that the tramway men of Llanelly had been used as political pawns, while Mr. Ben Tillett had engineered the strike for political purposes and for those purposes only.

MR. BALFOUR, in the witness box, said he served five years in a Dundee engineering works. His firm had always recognised Trade Unions, and based their system of wages on Trade Union scales. In his electoral campaign he advocated the usefulness of Trade Unions. When the threat to strike was received by the company from the Llanelly men, he told Mr. Tillett that he would debate the matter directly after his election business had concluded. Although he agreed to that, Mr. Tillett brought the men out, and thus prepared a foundation for the libellous statement which appeared in the Glasgow *Daily Record*. He (witness) had never refused to recognise the Trade Union. He considered that he lost his election through the libel.

Evidence was given by MR. A. MCCLURE, the plaintiff's election agent, to the effect that on the day of the poll, after the libellous statement appeared, the men who had hitherto supported plaintiff cordially, showed signs of hostility. He was also of the opinion that the publication of the statement made an adverse difference to Mr. Balfour's chances of success.

Addressing the jury for Mr. Tillett, MR. HEALY said as far as his client was concerned, he made the statement complained of honestly and *bonâ fide*, believing that it was true. The strike, far from being got up for political purposes, had been going on for months before Mr. Balfour's election contest, and he thought the documents would show that Mr. Tillett did his best to suppress the strike in Wales. It was begun against his wishes and the commands of his Union. Mr. Tillett at no time stated that Mr. Balfour had refused to support Trade Union principles. What he said was that Mr. Balfour had refused to recognise the Dockers' Union, and that was true.

After a two-day hearing,

MR. SHEARMAN said that the *Daily Record* would pay the plaintiff £1,000 as damages and a sum to cover his costs, and express their regret that the paragraph had appeared. They were satisfied that there was no want of sincerity on the part of Mr. Balfour, with regard to his attitude towards Trade Unions, and therefore the appearance of the paragraph did him considerable harm.

MR. HEALY (for Mr. Tillett) said the plaintiffs now saw that his client was not an electoral disturber as had been suggested, and that the strike at Llanelly had been threatened long before Mr. Balfour's election took place. Mr. Tillett now agreed that it would be unfair to suggest that Mr. Balfour had refused to recognise the Trade Union, and expressed his regret that the statement had appeared.

MR. DUKE (for the plaintiff) accepted the apology and the damages offered, and after his Lordship had expressed appreciation of the arrangement, judgment was entered for the plaintiff on the terms of the settlement.

X.L. ELECTRIC CO. *v.* ARON.

IN the Chancery Division on Friday, May 30th, Mr. Justice Neville had before him a motion by the plaintiffs in this action, by which they sought to restrain the defendant, until the trial or further order, from dealing with certain electric patents in contravention of his agreement.

MR. MORITZ, in support of the motion, said that the order asked for was to restrain the defendant from selling, offering for sale, parting with, dealing with, or otherwise disposing of, certain patents which he had sold to the plaintiff company, and from opposing certain patent applications that were pending. He understood that the defendants desired an adjournment in order to answer the evidence, but much damage might be done to the plaintiffs during the week, and he could not consent to the matter standing over until the following Friday without some undertaking.

COUNSEL for the defendants said that the injunction asked for was extremely wide, and he could not give an undertaking on the terms of it, but he was quite willing to undertake for a week not to part with, charge, mortgage, or dispose of, the two patents in question.

MR. MORITZ said he could not accept that. The second part of the injunction he asked for was the most important. The defendant had entered into a contract with the plaintiff company, by which he covenanted that he had presented applications for letters patent for improvements in the inventions, the letters patent for which had been assigned to the plaintiffs. The company had purchased the defendant's inventions, and he was afterwards taken into the company's employ as electrical engineer. It had been found necessary to dismiss him, and there was consequently a considerable amount of bad blood between them. There were applications pending for patents for his inventions, which under the agreement would belong to the company, and he was threatening to withdraw them or oppose them if made by the company. There was evidence that he had written to the company's solicitor that he was quite open to consider any suggestion coming from them, but unless something definite was arrived at immediately he should withdraw his application for patent No. 19,257 of 1912. That patent, said counsel, was a most important asset of the com-

pany. The agreement between the parties was that in consideration of shares in the company the defendant should assign to them the benefit of the two patents and secure the assignment of them to the company. That he had failed to do, though the share consideration had been assigned by the company. Further, he agreed to submit to the company and its expert advisers any future inventions he might make in connection with the two patents, or any improvements in them, and any inventions in connection with electrically-worked clocks, and such inventions were to be patented at the expense of the company, and the patents assigned to them. The defendant, at the expense of the company, was, when required, to apply for foreign protection, and the attitude the defendant had adopted was calculated to prejudice the company in America, Germany, and elsewhere. The company was a private company, formed on April 28th, for the purpose of carrying out the defendant's inventions, and on May 10th, besides being managing director, he was appointed advisory engineer and superintendent at a salary of £8 a week. From that post he had been discharged for alleged misconduct, and he had now made a distinct threat to withdraw these applications for protection, which were of vital importance to the company.

His Lordship said he would grant the injunction asked as an *ex parte* injunction over next Friday.

Counsel, for the defendant, said that the time for withdrawal before the Comptroller of the applications in question expired on Tuesday next, and he thought he ought to have authority from the company to apply to extend the time for withdrawal.

His Lordship said that seemed reasonable.

Mr. Moritz said he had no objection. The company would give authority by letter to apply to the Comptroller in the name of the company and its managing director to extend the time for withdrawal of the applications before him for a fortnight.

On that understanding, his Lordshp granted the injunction as asked over Friday next, the motion standing adjourned until that day.

London Electric Supply Corporation *v.* Westminster Electric Supply Corporation.

In the Chancery Division on Friday, May 30th, before Mr. Justice Eve, an application was made in this case that the order of the House of Lords should be made an order of Mr. Justice Eve's Court.

The application was granted.

Lady's Telephone Share Experience.

In the City of London Court on Monday, before Judge Lumley Smith, K.C., Mr. Walter J. Crumplin, Ockwells Cottage, Kimber Lane, Maidenhead, formerly a member of the London Stock Exchange (he having recently retired), sued Mrs. Kichgessner, 36, Upper Marylebone Street, for £50 5s. 5d. balance due on a purchase of National Telephone deferred shares. By way of defence, the Gaming Act was raised. Mr. Doughty appeared for the plaintiff, and Mr. Harold Travers for the defendant.

Mr. Doughty explained that the transaction sued on began in April of last year, when the defendant's daughter wrote on behalf of herself and her mother instructing the plaintiff to buy two Telephone deferred shares. They then stood at 158, and were subject to a certain amount of speculation, in view of the arbitration then proceeding between the Government and the company. The ladies imagined, of course, that the shares were going up as a result of the award. There was now a balance against the client.

Plaintiff said he carried the shares over at the defendant's request on several occasions, and cheques were sometimes paid by him and sometimes to him. On December 30th, she paid £13 14s. 10d. when the stock stood at 140. It then fell to 107, on account of the award coming out, and there was a further balance of £33, which defendant owed. The shares again fell, and the present balance was due. In November, he strongly urged the defendant to sell when the shares stood at 168, showing her a profit.

In cross-examination, plaintiff indignantly denied that the transaction was a gamble. Defendant told him she did not intend to take up the shares if he would carry them over, and that she was sure they would rise.

Mr. Travers submitted that the transaction was a gamble, and that the plaintiff could not recover.

Plaintiff added that he had actually paid for the shares, as he had to close the account and he had paid the differences. He was an agent for the defendant.

Mrs. Kichgessner, the defendant, said she never intended to take up the shares. It was only a speculation. She thought they would probably rise when the award was given.

Judge Lumley Smith: If this were a good defence nobody would ever lose any money on the Stock Exchange. I do not think it was a gaming or wagering transaction. Judgment for the plaintiff, with costs.

The National Telephone Co., Ltd., *v.* Postmaster-General.

In the House of Lords on Tuesday, their Lordships said that the appeal of the National Co. failed. They would give their reasons in writing later. As the case was one which ought to be disposed of at once they formally dismissed the appeal with costs, affirming the judgment of the Court below.

PARLIAMENTARY.

London County Council (Tramways, Trolley Vehicles and Improvements) Bill.

On the motion for the second reading of the above Bill in the House of Commons, an important motion was carried at the instance of Mr. H. Lawson. He moved "That it be an instruction to the Committee on the Bill to insert a provision in the Bill making the erection of trolley-vehicle equipments on, over, under, along or across any street or road in the County of London subject to the provisions of Sec. 23 of the London County Council Tramways (Electrical Power) Act, 1900." He said the question was whether the House, without any cause shown, should practically repeal the provision which was passed for ensuring that overhead wires should not be erected in London without the consent of the local authority of the borough concerned.

Mr. Morrison seconded the motion.

In the discussion which followed, Mr. Goldsmith pointed out that at the present time the borough councils had an absolute veto with regard to tramways in London, and could stop the overhead system of tramways in their particular districts. In the case of railless trolleys, however, the promoters had not to obtain the authority or the sanction of the road authorities before they came to Parliament. He contended that if the resolution were adopted, it meant that the railless trolley system would never be adopted in any part of the county of London, because each district wanted the most expensive system—the conduit system.

Sir W. Bull, who supported the resolution at the request of the Hammersmith Borough Council, expressed the opinion that in 20 years there would not be a tramway in London.

The instruction was carried by 119 votes to 40.

Electric Lighting Provisional Order (No. 1) Bill.—This Bill has been before the Standing Orders Committee and referred for Second Reading. It is for the purpose of confirming Electric Lighting Orders granted by the Board of Trade to the following: To the Urban District Council of Baildon, in the West Riding of Yorkshire; to the Urban District Council of Beckenham, in respect of the parish of West Wickham; to Wm. Albert Schultz, carrying on business as the Chipping Norton Electric Supply Co.; to the U.D.C. of Hazel Grove and Bramhall; to the U.D.C. of Itchen, in the County of Southampton; to the U.D.C. of Skelton and Brotton, in the North Riding of Yorkshire, with clauses enabling them to take a supply of power from the Cleveland and Durham County Power Co.; to the U.D.C. of Southborough, in the County of Kent; to the Burslem Corporation in regard to the inclusion of the whole of Wolstanton ward in the area; to the Truro Corporation; and to the Weaverham Electric Supply Co., Ltd., in respect of certain parishes in the Northwich Rural District.

Electric Lighting Order (No. 5) Bill.—On Monday, the Examiners found Standing Orders complied with in regard to No. 5 Bill, which confirms Provisional Orders granted by the Board of Trade to the following:—To the U.D.C. of Caerphilly (powers not to be exercised unless transferred to a limited company); to the Colne Valley Electric Supply Co., in respect of the parish of Pinner; to the Birmingham District Power and Traction, Ltd., in respect of the County Borough of Smethwick (a clause is inserted for the protection of the Shropshire, Worcestershire and Staffordshire Electric Power Co.); to the Urban District Council of Watford, in respect of the parish of Abbotts Langley; to the Wellingborough Electric Supply Co.

Tramway Provisional Order Bill.—The Examiners have passed the Bill promoted by the Board of Trade for confirming Provisional Orders granted to the Baildon U.D.C., for the construction of about a mile of tramway, and to the Newcastle-on-Tyne Corporation for the construction of a number of small junction lines.

L.C.C. Greenwich Generating Station.—Mr. W. Thorne asked the President of the Board of Trade whether his attention had been called to the recent breakdown at the London County Council Power Station at Greenwich; if he was aware that the breakdown was caused by over-loading the machinery in consequence of there not being enough machinery to generate the amount of power required for general use; and if he would cause an inquiry to be held in connection with the recent breakdown?—Mr. Buxton said he was informed by the London County Council that the breakdown in question occurred in consequence of a cotter falling out of the high-pressure piston rod of one of the engines, and that there was no foundation for the suggestion that the mishap was caused by overloading the machinery. He hardly thought that an inquiry, such as suggested, would serve any useful purpose.

Kent Electric Power Co.—The late Bill of the Kent Electric Power Co. to provide for the reduction and rearrangement of the capital of the company, was before the Examiners last week, and was found not to have complied with Standing Orders. The Bill will accordingly go before the Standing Orders Committee.

York Corporation Bill.—The York Corporation Bill has received the approval of the Unopposed Bill Committee of the House of Commons, and has been referred for Third Reading. The principal object of the Bill was to authorise the Corporation to purchase the gas undertaking, but as this was defeated by a citizens' meeting, it had to be abandoned. A number of minor matters were left in the Bill, including authority to acquire land for the purposes of the electricity undertaking.

Nottingham Corporation Bill and West Bridgford U.D.C. Bill.—Owing to an agreement having been come to between the promoters of the above Bills, opposition has been withdrawn, and they have been referred to the Committee on Unopposed Bills. The Notts. Corporation promoted a Bill for powers to construct tramways and provide trolley vehicles and motor-omnibuses, but by an arrangement with the West Bridgford Urban District Council, who are seeking to run motor-'buses, the powers for trolley vehicles are dropped.

Various Bills.—In the House of Commons on May 27th the Chesterfield Corporation Railless Traction Bill and the Westgate and Birchington Gas and Electricity Bill were read a third time.

In the House of Lords on the same day the Herne Bay Gas and Electricity Bill was read a second time, and the Crowborough District Gas and Electricity Bill passed its third reading.

In the House of Commons on May 30th the Rhondda Tramways (Railless Traction) Bill, and on Monday the Metropolitan Electric Tramways (Railless Traction) Bill were read a third time. The London Electric Railway Bill, Metropolitan District Railway Bill, and Wimbledon and Sutton Railway Bill were read a second time on Monday.

In the House of Lords on June 2nd the following were read a first time:—Metropolitan Electric Tramways Railless Traction Bill, and Rhondda Tramways and Railless Traction Bill.

BUSINESS NOTES.

Consular Notes.—Egypt.—In his recent report on the condition of Egypt in 1912, Lord Kitchener states that the Telegraph Department earned £E.136,888, an increase of £E.9,922 over 1911. Working expenses amounted to £E.113,500, an increase of £E.3,574. There has been an increase in all classes of messages sent and in the revenue derived from trunk telephones. Two new trunk telephone lines, viz., Ismailia to Suez and Cairo to Zagazig, have been opened, a telegraph line from Suez to Safaja, in the Red Sea littoral, *vid* Jemsa, two telephone circuits at Safaja, and part of the line along the western coast of Sollum. The telegraph capital account stands at £E.189,921, the interest on the capital being £E.12 3s. 9d. A new scheme of deferred foreign telegrams at cheap rates has been introduced. Fifteen new offices have been opened during the year.

In a further report, dealing with the Sudan, Lord Kitchener states that the number of telegrams sent in the Sudan during 1912 increased by 6 per cent., and this increase is reflected in the revenue. There have been no extensions of the telegraph system during the year, which now consists of 4,777 miles of line and 9,896 miles of wire. The telephone service continues to expand, especially in the towns.

China.—The American Consul at Hankow reports that there are three electric light plants there, one for the Chinese city, and two, one of them very small, in the foreign concessions. There is a telephone service operated by the German post-office in the foreign concessions, and a Chinese telephone service in the native city. The Chinese telephone service connects with the neighbouring cities of Wuchang and Hanyang. In Wuchang there is a small electric plant, mostly for official use, but it is understood that a municipal system is contemplated. In Changsha, the capital of Hunan Province, there is a fair electric light plant, and there is also a telephone system, though the latter is little used by private persons. In Kinkiang there is no electric light plant, in Nanchang there is a small plant, and in both cities there are telephones, although there is no system in general use by any considerable number of subscribers. It would be extremely difficult, if not impossible, for a foreign company to get any public service concession, and the number of Chinese merchants with whom a joint Chinese-foreign enterprise could be conducted is still very small.

Hawaii Islands.—Dealing with the prospects of British trade in these islands, the British Consul, in a recent report, states that the lack of direct transportation facilities is an obstacle. Further, local business interests and connections are all centred in the United States. It is, therefore, not possible to urge the ordinary method of having travellers visit the islands, as it is more than doubtful whether any resultant business would directly compensate for the time and expense of a special trip; nevertheless, should such representatives have occasion to pass through the territory it might in certain lines be worth while to delay a little to study the local market. Possibly the most likely way to advance the small British trade would be to encourage the attention of those already handling British goods in the United States. Articles which find a market there might also be able to get a footing in Hawaii, and having no further duty to pay, both stock and organisation in the United States would be available to compete for any business which might be open. Local firms being able to deal so much more easily with the United States than with other countries could be more readily approached from there than by direct trade; this will be particularly the case should the opening of the Panama Canal lead to larger imports from the British Empire to the Pacific coast of the States.

Philippine Islands.—Manila and Mangarin are now connected by wireless telegraph, says an American report. A powerful plant was installed at the sugar town under joint action of the Mindoro Co. and the Bureau of Posts. The former found it difficult to conduct its extensive industry without immediate communication. When the Mangarin station gets into swing it will be able to converse with Hong Kong as well as with the stations to be erected in the Southern islands. In the latter connection it is expected to be a helpful link in Philippine communication.

Canada.—The Canadian Minister of Railways has decided to establish wireless telegraphy between Le Pas and the Hudson Bay terminal when the harbour work is started. This will allow the department at Ottawa to keep in close touch with the progress of the work. Extensive preparations have been made to send north an expedition with dredges and equipment to start work on the harbour at the earliest possible date. The Government will probably do most of the work itself.

Aluminium Wire Prices.—It is stated that recent offers of Continental aluminium wire in the most marketable sizes of from 20 mm. to 15 mm. show a considerable advance over former quotations. When the price of ingots was £4 per cwt. the charges of wire ranged from £5 5s. to £6, whereas at present with ingots dearer wire has risen to from £6 10s. to £7 per cwt.

A Swiss Absorption.—It was expected when the Swiss firm of BROWN, BOVERI & CO. entered into a community of interests with the Alioth Electricity Co., which took place two or three years ago, that the eventual result would be an amalgamation of the two undertakings. It is now announced that Brown, Boveri and Co. have acquired by purchase all the workshops of the Alioth Co. and will continue them as the company's Münchenstein branch.

"Korfund."—THE KORFUND CO. have recently received the following orders for insulating machines with their "Korfund" cork foundation plates to prevent the transmission of vibration and noise:—

Belfast.—One 4,000-H.P. Diesel engine.
Hong Kong.—Two 550-H.P. Diesel engines.
Rushden.—Two 240-H.P. Diesel engines.
Southend-on-Sea.—Two 500-KW. Belliss-Crompton sets.
Wisbech.—One 70-H.P. Crossley gas engine.

Patent Applications.—The Comptroller-General has made an order restoring patent No. 22,125 of 1907, granted to the Westinghouse Brake Co. for "Improvements in automatic fluid pressure brake apparatus for railway and like vehicles." Messrs. Mathiesen Aktien-Gesellschaft, of Leutzsch, Leipzig, are applying for leave to amend Patent No. 22,342 of 1904, for "Improvements in Arc Lamp Electrodes." An announcement appears among our advertisements to-day.

Ebonite Tests at the N.P.L.—Referring to our note on the new Admiralty Specification for Ebonite, the ST. HELENS CABLE AND RUBBER CO., LTD., of Warrington, inform us that the National Physical Laboratory has made tests upon their ebonite made to the Admiralty specification, and has signified that it has passed the test required. The Admiralty test is the exceedingly severe one of 125,000 volts per millimetre. Apart from this very high-class ebonite, the company make other classes more suitable (in price) for general work.

Book Notices.—*Electrical Tables and Memoranda.* By S. P. Thompson, F.R.S. London: E. & F. N. Spon. Price 1s. net.—This is the second edition of the little waistcoat-pocket book, which constitutes the smallest of Dr. Thompson's many works. It is literally a *multum in parvo*, dealing with an extraordinary variety of subjects in its 131 pages; the treatment is, as would be expected, most lucid, and the matter is condensed to a degree only comparable with the tabloid system. We have read many pages of the tiny volume with interest, and find it fully up to date and packed with useful information, including a variety of tables. As a "pocket memory," it should be found very useful.

"Reports for the Year 1912 on the Geological Survey, the Geological Museum in Jermyn Street, the Science Museum at South Kensington, and the Work of the Solar Physics Committee." 1913. London: Wyman & Sons, Ltd. Price 1s.

"The Year-Book of Wireless Telegraphy and Telephony." 1913. London: St. Catherine's Press. Price 2s. 6d. net.

"Car Troubles: Their Symptoms and their Cure." By H. W. Slauson. London: Harper & Bros. Price 1s. net.

"Instructions for the Use of Calculating Rule for Illumination and Photometric Measurements." By T. Hirobe and R. Mitsuda. Tokio, Japan: The Electrotechnical Laboratory.

"Chronique Illustrée du Concours International de Télégraphie Pratique, Turin, 1911." Rome: Ministero delle Poste e dei Telegrafi.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 10. May 31st, 1913. Milan: The Association. Price L. 1·50.

"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol. XXX. April, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

British Manufacturers in Australia.—In the recently-published report of the Australian Association of British Manufacturers and their Representatives (430, Little Collins Street, Melbourne) reference was made to a directory that was being prepared by the Association. We have now received a copy of this publication, known as the "All-Red Directory." It contains only the names, &c., of members of the Association, as all members are entitled to have their names included in all three sections, together with full particulars of the goods which they manufacture, without any further charge beyond the annual subscription of £2 2s. The advantages derived from such publication and from circulation of the Directory are merely incidental to the general benefits of membership of the Association.

Electric Lighting for Motor-Cars.—THE CHLORIDE ELECTRICAL STORAGE CO., LTD., of Pendlebury, Manchester, remind us that many motor-car lighting equipments are coming into this country fitted with "Exide" accumulators, and that they manufacture this type of battery, as used on the "Delco" and other electric self-starting and lighting equipments. They also carry stocks of spare parts for these batteries.

B.T.H. Rotary Converters.—A most instructive pamphlet has recently been issued by the BRITISH THOMSON-HOUSTON CO., on the subject of rotary converters, which, while it naturally illustrates the methods adopted by this firm in particular, also covers in a brief, practical style the main features of rotary converter practice at the present time. It commences with a *résumé* of the characteristics of rotary converters, under which are discussed voltage and current ratios, armature heating, commutation efficiency, overload capacity, use of rotaries as three-wire balancers, and the power factor of rotaries running A.C. to D.C. Then follow several pages describing the principal methods that have been adopted for obtaining variable D.C. voltage with constant A.C. voltage and *vice versâ*, the starting of rotary converters, and a further section is devoted to construction, the whole of the pages being profusely illustrated with specimen machines, curves, diagrams of connections, &c.

Under "Variation of Voltage," are discussed reactance control (*i.e.*, variation of D.C. voltage by the introduction of reactance in the supply transformer or externally) simple vector diagrams being given; booster control — an A.C. booster being inserted between the slip-rings and converter armature, the power factor in this case being independent of load and voltage; regulator control (an induction regulator inserted between transformer and rotary slip-rings); split-pole control, particularly a method using a two-part pole, which has been developed by the B.T.H. Co., and is claimed to be the simplest that has been devised where voltage variation is required independent of power factor; lastly, brush-shift control, which is not recommended.

As regards starting, diagrams illustrate (1) A.C. starting by means of transformer taps, and for machines above 500 KW.; (2) induction motor starting, using squirrel-cage or slip-ring motors; the squirrel-cage motor is recommended, except where reduction of starting current is important. The induction motor is constructed with one pair less poles than the rotary, so that it is possible to speed the rotaries up considerably above normal speed. The connections for direct-current starting are also illustrated, and this is the best method to adopt when a direct-current supply is always available for the purpose.

The section devoted to "Construction" illustrates and describes the main details of the B.T.H. rotary, which, we note, has been built in practically all sizes up to 1,500 KW., and will (if required) be built up to 3,000-KW. capacity for any voltage up to 1,500 for 25-cycle work and up to 750 volts for 50-cycle work.

Diplomas. — THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., have been awarded a Diploma of Honour for their exhibit at the International Kinematograph Exhibition and Conference held in London recently.

THE WESTMINSTER ENGINEERING CO. have also been awarded a Diploma of Honour for their projection and photographic arc lamps exhibited at the same Exhibition. These are made at their works at Willesden Junction.

For Sale.—The Bermondsey Borough Council has for disposal three small generating sets. See our advertisement pages in this issue.

Catalogues and Lists.—MESSRS. VERITYS, LTD., 31, King Street, Covent Garden, W.C.—Priced and illustrated leaflet (No. 742) particularising their "Aston" ceiling and roof fans for D.C.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—We have received a collection of new lists just issued, in an expanding binding cover. The following manufactures are covered—brief descriptive matter on a fancy paper, being followed with illustrations printed on coloured art papers:—Split conductor protection; sheet-steel switchgear (three-phase generator panel up to 3,000 volts); cable glands and fittings for armoured cables; no-voltage release; wall-operated switchgear; plugs and sockets; cast-iron distribution boxes.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—Advance copy of 20-page booklet giving a full illustrated account of the "Fortiter" direct-current watt-hour meter.

THE MIRRLEES WATSON CO., LTD., Scotland Street, Glasgow.—Pamphlet C32 gives an illustrated description of the latest surface condensing installation (Mirrlees-Leblanc rotary type), supplied by them to Pinkston Power Station, Glasgow. Readings are tabulated giving results of the plant running under the usual working conditions.

THE DIAMOND COAL CUTTER CO., Stennard Works, Wakefield, Yorks.—Twenty-page booklet, being a special exhibition number of their "Machine Mining Monthly," issued on the occasion of the Mining Machinery Exhibition, now open at the Royal Agricultural Hall. It contains half-tone views of many of the shops at the Stennard Works, and a list of users of the "Diamond" coal-cutting machines and conveyors in Great Britain.

MESSRS. ISARIA, LTD., 208, Tower Bridge Road, London, S.E.—Sixteen-page pamphlet containing full tabulated particulars and prices of their "Isaria" table, oscillating, self-rotating, ceiling and port-hole electric fans, also shutters for port-hole fans, starters and rheostats. Copies of the list may be obtained on application.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., Stafford Works, Rea Street South, Birmingham.—48-page comprehensive price list of "M.E.M." switchgear. Thirty pages are devoted to ironclad lines, the remainder dealing with various types of fuses, fuseboards, distribution boards, knife switches and other manufactures. The illustrations are numerous and admirably clear, a good art paper being used throughout. Prices are very plainly shown at the foot of each page. The firm who are now specialising in the manufacture of ironclad switches and switchgear, have recently made extensions and additions to the plant in their works, and larger stocks are now being carried thus ensuring prompt delivery. By mutual agreement, Messrs. G. C. Fisher & Co. ceased to represent the company's interests for Glasgow and Scotland last month, and Messrs. Andrews & Co., 198A, St. Vincent Street, Glasgow, are now their representatives, and are carrying stocks of their standard manufactures.

MESSRS. LANDIS & GYR, LTD., 28, Denman Street, London, S.E. — Leaflet relating to their switchboard wattmeters for single-phase A.C. circuits and three-phase circuits with balanced loads. Dimension sketches and diagrams of connections appear.

MESSRS. DAVID BROWN & SONS (HUDD., LTD.), Huddersfield.—16-page booklet containing information and excellent illustrations describing the "DBS" spur gear and its application as a speed reducer; also a list of double helical gears.

Mining Machinery Exhibition.—This exhibition at the Agricultural Hall, Islington, closes at the end of this week. We shall refer to the matter in our next issue.

Canada.—Mr. James A. Farrell, president of the United States Steel Corporation, in testifying as to the corporation's export trade in the United States Government suit, referred to the Canadian business in part as follows:—"Through Montreal we sell about 60,000 tons of wire product a year, sheet-iron, mine rails, and sometimes standard rails, when they cannot be supplied by their own corporations. We are now supplying the Canadian Northern Railway with 25,000 tons of rails shipped by boat from Chicago and thence by rail to Calgary, where they cost $47.13 delivered. At Vancouver we supply much material, but the freight weight from Pittsburg there is $18 a ton. Material from Liverpool or Antwerp may be shipped for $6 to $8 a ton. After we established our office there we found it necessary to run a steamship service there. Our ships leave about every two months, making stops all along the line. On the return we go into a general merchandising business."—*Canadian Engineer.*

Dissolutions and Liquidations. — ADAMS MANUFACTURING CO., LTD.—The following creditors were, on May 9th, appointed a committee of inspection in this matter:—Mr. Price, of Dunlop Rubber Co., Ltd.; the secretary of the Varley Magnet Co.; Mr. Brain, of Thomas Green & Co.; Mr. Watson, of the Rochdale Electric Co.; Mr. George Smith, of James Smith (Norwood), Ltd.

H. A. HARVEY & CO., LTD.—A petition was to come before the Court on Wednesday for the winding up of this company.

SOUTHPORT AND LYTHAM TRAMROAD CO.—A meeting is called for July 3rd, at 14, Castle Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. J. T. Wood.

HILO MANUFACTURING CO., LTD.—A meeting is called for July 4th, at 58, Coleman Street, E.C., to hear an account of the winding up.

CANADIAN BRITISH ENGINEERING CO., LTD. (registered in 1910). —A meeting is called for July 7th, at 18, Austin Friars, E.C., to hear an account of the winding up from the liquidator, Mr. P. J. Hellis.

R. & H. DOBSON, electrical engineers, 39, Dean Road, Salford.—Messrs. Robert & Hugh Dobson have dissolved partnership. The latter attends to debts, &c.

ENGINEERING INSTRUMENTS, LTD.—This company is winding up voluntarily, with Mr. J. W. Watson, Tubwell Row, Darlington, as liquidator. An agreement has been made between Mr. J. E. Hodgkin, on behalf of the company, and the Skerne Works, Ltd., for the sale or transfer of the undertaking and the assets to the Skerne Works, Ltd. A meeting of creditors is called for June 11th, at Savings Bank Chambers, Tubwell Row, Darlington.

BULLOUGH'S ADJUSTABLE RAIL JOINT SUPPORT CO., LTD.—This company is winding up with Mr. Raymond Wells, 2-6, St. John Street, Smithfield, E.C., as liquidator.

Fire.—A fire on Monday afternoon at the extensive grocery premises of Mr. William Wakefield, Hetton-le-Hole, County Durham, caused damage to the value of over £5,000. An electrical plant with dynamos was completely wrecked.

Metal for Handling Acetic Acid.—Referring to an inquiry in our last issue, the BRITISH ALUMINIUM CO., LTD., write to point out that vessels made of pure sheet aluminium with autogenously welded seams are practically immune from corrosive action due to juices containing acetic acid. The information may be of interest to other readers besides the correspondent who made the inquiry.

Trade Announcements.—MESSRS. PETO & RADFORD, LTD., who have been at 100, Hatton Garden, E.C., for more than 25 years, are removing their London headquarters to 12, Heddon Street, Regent Street, W., where they will have facilities and space required by their increasing business, including covered accommodation for fitting up 25 cars at a time.

MR. T. W. MURRAY, of the Felix Street branch of Messrs. Drake and Gorham, Ltd., of Westminster, is no longer connected with the firm.

MESSRS. W. A. SHAW & CO., electrical engineers, of Warren Street, Stockport, have taken new premises at 107, Princes Street, Stockport.

MESSRS. EDWARD LE BAS & CO., of Dock House, Billiter Street, E.C., notify that their telephone numbers have been altered; in future they will have five lines, all No. 5463 Avenue.

LIGHTING and POWER NOTES.

Abercarn.—It was reported at the May meeting of the U.D.C. that the B. of T. had refused to grant the Council a prov. order for electric light.

Accrington.—Fourteen arc lamps in the Market Hall are to be replaced by twenty 200-C.P. Osram lamps. It is computed that the change will effect a saving of nearly £49 per annum. The recently-introduced alternative charge with regard to electric lighting has been adopted by 47 persons.

Atherton.—The D.C. has approved of an amended estimate of the new electrical sub-station prepared by Mr. T. L. Miller, the consulting engineer, and application has been made to the L.G.B. for sanction to a loan of £6,300 instead of £5,500.

Banbridge.—The B. of T. has decided not to grant the prov. order recently sought by this Irish town.

Barrow-in-Furness.—At the T.C. meeting on June 2nd, Alderman Smith stated that the accounts of the Electricity Committee for the year ending March 31st last had now been completed. The total capital expenditure upon the undertaking had been £120,802, and of the amount they had repaid, £39,250, leaving the existing debt at £81,552. The revenue during the year, as compared with the preceding 12 months, had increased by £1,694, and it was the largest amount they had ever had. Unfortunately, the costs had increased to a greater extent, namely, £2,562, and the net profits had been reduced to £971. The increased revenue was made up of £609 for lighting, £526 for power, and £559 for traction. On the expenditure side, they had had to provide for increased rates and increased cost of coal. The output was increased by 310,940 units, which was equal to 22 per cent. Before next winter it was hoped to complete the extensions to the works, whereby they would be able to reduce the cost of production. The report was approved.

Bexley Heath.—Messrs. Gillespie & Beales recently organised a successful demonstration of electric cooking with the "Tricity" cooker. The lectures and demonstrations were given by Mr. Grogan on the British Electric Transformer Co., Ltd., who has interested large audiences twice a day during the past week.

Birmingham.—Sanction has been received from the L.G.B. to the borrowing of £50,000 for the erection of additional plant at the Summer Lane Station.

Bispham.—Formal sanction has been received for the borrowing of £8,155, of which £3,835 is for excess expenditure on buildings, plant and street lighting; £2,780 for additional plant wanted; and £1,540 for prospective expenditure. The Board deferred the granting of the Council's application for a loan for the extension of electric lighting to the Greenlands end of the district, because the consent of the B. of T. had not yet been obtained by the Council.

Blackburn.—The annual report of Mr. Wheelwright, the borough electrical engineer, on the electricity department, shows a net profit of £3,521 on the last year's working. The total units generated for lighting, power, traction and heating amounted to 6,108,685, an increase of nearly a million on the previous year. The series of interesting curves published with the statement show the progressive character of the undertaking, which has approximately 1,500 looms, with individual motors, connected to its mains in addition to other power users, who altogether aggregate 5,000 B.H.P. The report states that a noticeable increase has occurred in lighting supply, which has been introduced into the electrically-driven weaving sheds. A second turbine set has been installed, and the whole of the first three-phase H.T. contract has been completed. The original turbine installation last year was greatly delayed by the strikes, and consequently the advantage from its use was not felt. One of the curves included shows typical loading of the three-phase mill supply on March 17th last, and affords an instructive comparison with typical week-day and Sunday load curves, which are also given.

Brighton.—On the suggestion of Mr. J. Christie, engineer and manager of the electricity works, the Lighting Committee of the T.C. recommends the purchase of electric cooking apparatus, to be let out on hire, at the cost of £250, and the purchase of six Jackson cookers at £12 1s. each. Mr. Christie also suggests that a loan of £3,000 or £5,000 should be applied for, for the purchase of cooking apparatus, and that this should be included in a large loan for mains and feeders, motors and street lighting on the Front.

Burnley.—The electricity department has decided to construct a sub-station in the Burnley Lane district, and the estimated cost is £1,300. Plans have already been passed.

Canada.—The City of Alberta is proposing to spend £65,000 in extensions to the electric light department.

China.—The General Electric Co. is supplying through its Chinese branch, three H.T. three-phase alternators, coupled to Bolinders oil engines, and a 14-panel switchboard for the Fatshan Electric Light and Power Co., which will supply Fatshan, near Canton.

Cleckheaton.—In the annual trading accounts for the year ended March 31st, the electricity and destructor department of the Council shows a loss of £635, as compared with a year ago.

Continental Notes.—RUSSIA.—According to a report from St. Petersburg, the electric power station at the well-known Briansk Iron and Steel Works was destroyed by fire a few days ago.

FRANCE.—La Société de l'Energie Electrique du Littoral Mediterraneen reports a net profit of £60,863 for the last financial year, as compared with only £47,154 in the preceding 12 months.

Croydon.—The report on the sixteenth year of the working of the Corporation electricity works was presented at the B.C. meeting on Monday, with the accounts. The borough electrical engineer (Mr. Alex. C. Cramb) reported an increase of 242,516 units sold, of which 56,558 were for heating and cooking. It was hopeless, he remarked, to expect any material increase of business from cooking until the Corporation took in hand a satisfactory scheme for developing this business by hiring out cookers at reasonable rates. The increase of £4,082 in capital expenditure was entirely upon distribution. On the revenue account the total expenditure was £40,063, an increase of £5,074; and the total receipts were £66,740, an increase of £4,147. The cost of generation went up owing to the increased coal bill; coal contract prices had risen from 11s. 11d. per ton in 1909-10, to 18s. 3d. for certain contracts of the present year. There had been an advance in prices from 10 per cent. to 20 per cent. on practically all material purchased. At the end of the year the reserve fund stood at £39,031, plus £1,045 interest on investments, but £8,026 had since been withdrawn for new plant. There were outstanding liabilities for work chargeable against this fund amounting to £7,693. Owing to the coal strike in the spring of 1912, the new 1,000-KW. steam turbine plant, which should have been running last November, was not yet complete. A credit balance of £2,792 was carried to the appropriation account, from which £3,000 was taken towards relief of the rates. The auditors pointed out that £6,466 had been debited to revenue account, which might have been regarded as capital. The chairman of the Lighting and Electricity Committee strongly protested against the Finance Committee having taken a further £3,000 of the profits to relieve the rates, against the Committee's will. The money was needed for use in the business. Alderman Lillico remarked that that would mean that the rates would never get any benefit at all. Alderman Fox suggested that the Committee's plan now of charging certain large expenditures to revenue was to prevent the Finance Committee getting anything from the rates next year. Alderman Betteridge calculated that if coal had remained at the price it was three years ago, they would have been £8,000 or £9,000 more to the good. An amendment that the expenditure on certain new works relating to distribution and a new induced-draught plant—involving over £1,700—should not be charged to revenue, was defeated by a large majority.

Dundee.—The accounts of the Corporation electricity department for year ending April 30th, 1913, have just closed with a net profit of £7,028. The increase in the sale of units is between 1½ and 2 millions, representing an increased revenue of £4,000. The bulk of the increase is again for power purposes, although there is a gratifying increase of a quarter of a million units for lighting. On the expenditure side, there is, of course, a big increase in the coal account, which latter is fully £3,000 more than last year, while the assessments and taxes are also £1,000 higher due to a certain extent to the large profit in the previous year. The whole of the profit has been allocated to the reserve fund, bringing this up to fully £21,000, which is very creditable when it is considered that this has practically been built up in three years.

Eccles.—The revenue account of the electricity undertaking for the year ended March 31st, shows a profit of £111, based on the payment for energy by the Salford Tramways Committee from April, 1912, being calculated at the rate of 1d. per unit, both subject to adjustment on a settlement of the rate to be paid. The amount has been transferred to the credit of the reserve fund.

Officials of the Corporation have discussed with officials of the Salford Corporation the terms of settlement in reference to the price to be paid by the latter to the Eccles Corporation for energy supplied to the cars running in the borough, which is referred to on page 936.

Epsom.—The U.D.C. has applied to the L.G.B., for sanction to borrow £450 to defray the cost of services in connection with the electricity undertaking.

A L.G.B. inquiry was held on the 23rd ult., into the Council's application to borrow £500 for laying an electricity main in connection with the water undertaking. The inspector was informed that the pumping could be done by electricity, at the rate of 3¾d. per thousand gallons. He afterwards visited both electricity and waterworks.

Ford.—The Sunderland R.D.C. has received an offer from the Durham Electric Supply Co., to illuminate the parish of Ford at 30s. per annum for each 50-C.P. lamp, plus 8s. for maintenance. The Council has asked the company to make the same offer in regard to the areas of Castletown and North Hylton.

Guatemala.—The town of Ocos is threatened with outer darkness. According to the *Popular Electricity Magazine*, a steamer of the Kosmos Line, about four years ago, was carried into shoal water by a tidal wave, and remained fast, though undamaged, near the shore. A native is said to have utilised the ship's lighting

plant during this period for supplying electricity in the town. Now, however, a salvage company has succeeded in refloating the vessel, and, incidentally, deprived the town of its electricity supply.

Grimsby.—The T.C. has received from the L.G.B. sanction to loans of £8,760 for additional plant for the electricity works, £420 for extension of cooling towers and oil separators, and £6,000 for mains (prospective).

Halifax.—The Tramways and Electricity Committee proposes to lay a H.T. cable along the main road to Well Royd, and then to erect an overhead line across open country to the premises of Messrs. C. Lindley & Co., Ltd., Beauvoir Works, Luddenden, at an estimated cost of £1,364, subject to the consent of the B. of T. being obtained. The Town Clerk is instructed to make the necessary application to the B. of T.

The Corporation has received the sanction of the L.G.B. to the borrowing of £23,180 for the provision of electricity plant and mains.

Hebden Bridge.—An inquiry was held by Mr. T. C. Ekin, on behalf of the L.G.B., into the request of the Council for sanction to borrow £3,250 for extensions to the electricity works. A ratepayer who was present at the inquiry said that there was a feeling amongst ratepayers that as regards efficiency and output the works had not come up to expectations, and recently the supply of electricity had been very erratic.

Heston-Isleworth.—The anomaly of charging some 100-C.P. lamps at £5 per annum and others £3 being considered undesirable, the U.D.C. has adopted the electrical engineer's advice to charge all such lamps in future at £4 per lamp; and also to reduce the price of 50-C.P. lamps from £3 to £2 15s. each. This will mean a reduction in the Council's charges for public lighting of £91 10s. per annum, and a corresponding decline in revenue, but the concession, it is felt, will be ultimately to the advantage of the department.

Mr. Rycroft's annual report to the Electricity Committee states that the total income for the past year was £8,878, and the working expenses £4,308, leaving a gross profit of £4,569, and a net profit of £409, after payment of £4,160 in respect of interest and repayment of principal. The net capital expenditure at the end of the year was £66,970, and the percentage of gross profit to capital expenditure, 6·8 per cent. In the previous year, the total income was £8,321, the gross profit £4,273, and the net profit £150. The output for the 12 months in units generated was 1,094,789, compared with 1,040,774 for the previous year. In regard to units sold, there was a net increase of 44,201, which may be considered satisfactory, as it is chiefly made up of new small consumers and a general expansion in business. The engineer comments on the number of improvements effected during the year, both in respect to machinery and the organisation of lighting arrangements, and notes with satisfaction that the first month of the current year shows an increase over the corresponding month of the year under review of nearly 20,000 units.

Japan.—According to the last Japanese mail, negotiations are in hand with the view of effecting an amalgamation of the four companies at present supplying electrical energy for lighting and power purposes in Tokio.

Keighley.—The Corporation has applied to the B. of T. for an order for powers to supply the urban district of Bingley with electricity in bulk. It is the intention of the Board to make the order.

Leek.—At a recent meeting of the U.D.C. it was intimated that Messrs. Nicholson & Hall, Ltd., a large firm of silk manufacturers, would not renew their contract for supply from the Corporation electricity department beyond the present year. The firm intends to extend the use of electricity throughout its mills, and to install its own generating plant of 800 H.P., and it is expected that the cost of power will be not more than ·55d. per unit, a price at which the Council is unable to compete. Special meetings of the Council and Committees are being arranged to consider the matter.

Leicester.—The T.C. on May 27th adopted recommendations from the Tramways and Electricity Committee to install additional generating plant, at a cost of £52,350, in order to cope with the demand for power. A 5,000-H.P. three-phase turbo-generator is to be installed at the Lero generating station, with reversible rotary converters, switchgear, &c., and steam-raising plant; at the Aylestone station a 500-H.P. rotary converter is to be provided, and high and low-tension cables are to be laid in the various areas.

Liverpool.—The Mersey Docks and Harbour Board has decided to lay an electric supply main from the north-east corner of Salthouse Dock to the Albert Dock warehouses, at at estimated cost of £800.

Llandudno.—Madoc Street and Lloyd Street are about to be lighted by electricity.

Representations having been made by leading hotel proprietors for more favourable terms for electricity for lighting purposes, the Electricity Committee recommended to the Council that a supply be provided at 3½d. per unit (as now), but that the minimum should be reduced from 15,000 to 10,000 units, with a discount of 2½ per cent. for prompt payment—these terms to apply to all consumers of 10,000 units per annum. The Council, however, has adopted an amendment to the effect that the Electric Light Committee should consider whether it would be possible to make a reduction to the general consumer.

London.—FULHAM.—The gross surplus on the working of the undertaking during the year ending March 31st last amounts to £6,020, as compared with £2,512 in the previous year. The net available surplus is £4,666, and gives a total available revenue balance of £7,899 to be carried to the next year's account. The revenue account shows a gross income of £40,988, as compared with £34,219 for the previous year, while the gross expenditure amounted to £36,322, as against £32,678. The total number of units sold for private purposes during the year was 3,091,166 at an average net rate of 2·352d. per unit, as compared with 2,505,747 units the previous year, at an average rate of 2·422d. per unit. The percentage of increase in the units sold during the year 1912-13 over the year 1911-12 is thus equal to 23·4d., while the actual increase in income derived from private sales was £4,989. The outstanding capital at March 31st amounted to £235,104, and the total capital repaid amounted to £49,363, equal to 17·35 per cent. of the total loans taken up. The showroom trading account shows a total income of £265, against an expenditure on stores of £224 and on rates, taxes, &c., of £155.

An expenditure of £295 has been authorised for the complete equipment of a new sub-station to improve the supply to consumers on the Queen's Club Gardens Estate, West Kensington. An expenditure of £980 has also been authorised for the erection of another new sub-station; &c., at Brandenburg Road to improve the supply in the Crabtree district.

BERMONDSEY.—The additions at the electricity station have been assessed at £1,590 gross and £530 rateable.

Manchester.—The detailed statistics and accounts of the electricity undertaking for the year ended March 31st, which were before the Electricity Committee last week, show that sales of current produced £467,194, as against £427,701 in the previous year. Hire of motors yielded £10,293, as against £8,616. Working expenses, other than capital charges, absorbed £253,561, as against £215,895—the difference being due to additional consumption of coal, expenses of new business, and inflated coal prices. The balance left was £223,926, as against £220,422. Average costs of production worked out at 1·033d. per unit sold, against 1·045d. in 1912. The cost of coal over the year was 12s. 4d. per ton, against 10s. 10d. in the previous year. The average price realised in pence per unit sold were 1·085 for lighting and power, and 1·046 for traction, as against 1·131 and 1·017 respectively in the previous year. The total units sold were 104 millions, against 93 millions in the previous year. On mains, the net addition was 15 miles 1,147 yards. Important developments in the lighting of the streets by electricity have taken place. The balance of £223,926 was appropriated as follows: Interest, £67,745; statutory sinking fund and voluntary supplementation thereof, £127,850; rate aid, £24,500; loss on India 3 per cent. stock, £3,831.

Mr. T. C. Ekin conducted a L.G.B. inquiry last week into an application to borrow £75,000 for electricity purposes. Mr. P. M. Heath, deputy town clerk, said the sum was made up of £45,000 for mains, £15,000 for services, and £15,000 for consumers' sub-stations. Mr. S. L. Pearce, chief electrical engineer, said they were asking for rather less than the amount allowed by the Board during the past three years. For the year ended March 31st the total units sold for all purposes was 104,340,000 units, an increase of nearly 11,000,000 units on the previous year. Mr. P. Percival, who opposed the application on behalf of the Ratepayers' Association, said he understood that the money for sub-stations was required chiefly for large power consumers, in which case these consumers had an unfair advantage over the large body of ratepayers. The inquiry was closed.

Neath.—The B. of T. has granted the R.D.C. an order empowering it to supply electricity in all the parishes of the Vale of Neath and the Dulais Valley.

Nottingham.—The Lighting Committee, reporting on the working of the department during the year ended March 31st last, states that experiments are still being carried out with clockwork automatic lighting and extinguishing apparatus, which continues to act very efficiently. The apparatus is now attached to 486 lamps. As the most efficient method of lighting, four powerful electric lamps have been erected across the middle of the open space at the top of Derby Road. This had proved most satisfactory, both as regards the lighting and the reduction of the danger arising from the cross traffic.

Portsmouth.—A special Electric Light Sub-Committee is considering the electric power rates charged in various towns with a view to generally reducing the rates in Portsmouth and securing a better motor load.

St. Helens.—A L.G.B. inquiry was held on May 28th into the application of the T.C. for a loan of £3,700 for electricity purposes—£1,049 in respect of excess expenditure on a loan of £10,800 sanctioned in 1911, £511 for switchgear, and £2,040 for a 2,000-KW. alternator. There was no opposition.

Salford.—The Council's E.H.T. switchgear is to be divided into two parts; this proposal will involve the provision of three extra isolation switches and five blank operating panels; the work is to be carried out by the British Westinghouse Co.

Stafford.—In pursuance of the arrangement as to profit-sharing by the employés at the E.L. works, the T.C. has for the past year paid a bonus of 9·90 per cent. on the wages paid, as against 11·7, 10·4 and 7·9 per cent. in the three previous years.

Stoke-on-Trent.—The T.C. has decided to lay a high-tension main from the Burslem works to the Tunstall boundary, in order to supply *en route* current to Mr. Alfred Meakin's Highgate Tile Works and the Goldendale Iron Works. The cost will be £3,500.

Stretford.—The U.D.C. is presently contemplating considerable extensions to plant, &c., 1,000 KW. is mentioned, at the generating station at Longford Bridge. The capacity of the plant at present is 1,800 KW.

Swansea.—After considering the price of current supplied to theatres and picture halls, the Electric Light and Tramways Committee of the T.C. has decided to reduce the charge from 3½d. to 3¼d. per unit. The revenue derived from these places of amusement is about £2,000 a year.

Tempo.—An electric lighting company has been formed in this Ulster village, the power required being obtained from a suction gas engine and water-wheel at a local saw mill.

Ventnor.—The U.D.C. has decided to enter into a three years' agreement with the Electric Light and Power Co. for public lighting, with 24 800-C.P. lamps.

Wallasey.—The Electricity Committee contemplates extensions on a large scale and the T.C. is to be asked to confirm a recommendation that borrowing powers to the extent of £65,000 be applied for. The scheme is to secure a site near the gasworks and build a new three-phase power station. It is proposed to use the present building in Seabank Road as a transforming and converting sub-station.

Waterford.—Mr. Mark Ruddle, city electrical engineer, Dublin, has visited the town at the request of the Corporation to report as to the advisability of starting a municipal electricity supply undertaking.

West Ham.—The Education Committee has decided to experiment by heating a school with electricity.

Wood Green.—At the May meeting of the U.D.C., an important statement was made by Mr. W. P. Harding, the clerk, upon the present position of the electric light question. As already reported in the ELECTRICAL REVIEW, the Tottenham and Edmonton Gas Co. has promoted a Bill to supply the district of Wood Green with electric light, and the North Metropolitan Electrical Power Supply Co. is also anxious to supply the district. The clerk reported that, as the result of a two days' inquiry held by the B. of T. into the application of the North Metropolitan Power Distribution Co. for a prov. order, the Board decided, after hearing all parties, not to proceed further with the application. On May 1st a Committee of the House of Commons sat to hear the application of the North Metropolitan Electric Power Supply Co. to allow it a *locus* to oppose the Bill of the Gas Co., but the Committee decided that the Supply Co. was not entitled to be heard in opposition to the Bill, and disallowed the *locus* accordingly. The petition of the Tottenham Urban District Council against this portion of the Bill had been withdrawn. Several hundreds of notices had been served upon the owners, lessees and occupiers of all dwelling houses within 300 yards of the proposed site of the Gas Co.'s generating station, and only one objection had been offered. It would now be open for the Electric Power Co. to apply to the Committee of the House of Lords for a *locus*, but, in view of the facts, the clerk concluded there was very little chance of any Committee of the House of Lords allowing a *locus* at this stage.

Worcester.—The accounts of the electricity undertaking, which were presented to the City Council on Monday, showed that the income for the year ending March 31st, 1913, amounted to £19,418, compared with £17,294 for 1911-12, an increase of £2,124. There was a net profit of £640, but this, and a sum of £1,526 from the general district fund, had been spent in carrying out improvements, chiefly in adopting the change from single-phase to polyphase system. This change over had been expedited because of the unprecedented increase in the demand for power. During the year, 62 new customers had been connected, and the total increase of demand was equal to 9,742 30-watt lamps. There had been an addition of 61,721 units for lighting, and for power purposes an increase of 303,840 units. The costs of production had fallen, despite substantial increases in certain charges, from 1·0d. to ·941d. per unit sold. The chairman of the Committee said there had been a phenomenal demand for power and lighting. The capital expenditure on the undertaking had been £168,588, and £81,000 had been written off.

Worthing.—Acting on the recommendation of the Electricity Committee, the T.C. approved of extensions to the plant and buildings at the generating station at an estimated cost of £6,750. Of this sum £4,850 is for extensions of the plant; and in recommending the purchase of a Diesel engine of approximately 400 B.H.P., direct-coupled to a generator of 260-KW. capacity, the resident electrical engineer, Mr. G. Porter, says that the experience of the past 16 months with Diesel engines has been extremely satisfactory. During the year ending March 31st last, the use of the oil plant enabled the fuel bill to be reduced by £750 with an increase of 10·8 per cent. in the number of units sold, as compared with the figures for the previous year. The proposed extension of the engine room buildings will afford space for a future 350-KW. set when required.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Tramways Committee has approved of the report and recommendations of a Sub-Committee regarding the tramways extension in the city. The scheme involves the running of motor-omnibuses and the equipment and running of railless trolley cars. The estimated cost is £7,830 and £6,230 respectively.

Accrington.—For some time past the accommodation at the car-sheds has been inadequate, and Mr. Pilling, general manager, has now prepared a preliminary report. The Electricity Committee has gone into the matter, and the borough engineer has been instructed to prepare plans for an extension.

Bingley.—A conference has been held between representatives of the U.D.C. and of the Bradford Corporation with reference to the commencement of the Bingley tramway. At a meeting of the U.D.C. Mr. Dawson, who formed one of the sub-Committee, stated that after discussion the conclusion arrived at was that there was no reason why the Corporation should not go on with the work of laying the line forthwith. The powers granted required that the work of construction was to be substantially commenced within 12 months, and as the powers were granted on August 6th last year, he thought the requirements would be met, and that every preparation was being made.

Blackpool.—On May 30th the brake on a Promenade car at the Gynn failed to act, and the car ran across the road, crossed the Fleetwood tramlines, and was only prevented from descending the steep Warbrick Hill by colliding with a trolley standard. Fortunately there was no Fleetwood car passing, or there might have been a serious smash.

Bradford.—The city tramways traffic report for the 54 days of the year show that the receipts were £46,018, and the car-mileage 920,800, against £44,193, and 892,262 miles for the 55 days of last year. The receipts for the present year show an increase of £1,825 on last year.

Brighouse.—The T.C. has complained to the Halifax Corporation about the totally inadequate service of cars from Brighouse to Bailiff Bridge, especially since the inauguration of the Bradford Corporation tramway service to that place.

Croydon.—The figures presented at the B.C. meeting on Monday showed increased mileage run and a considerable decrease of passengers, due to motor-'bus competition. To meet it the whole of the Council's 75 cars were in service on a recent Saturday, Sunday and Monday. The chairman of the Tramways Committee (Councillor Denning) declared that it would be suicidal, with the present competition, to reduce the mileage.

Darwen.—Instead of giving the work to an agent as formerly, Darwen Tramways Committee have decided to take over all matters concerning advertisements on Corporation tramcars.

Davyhulme.—An agitation has been set on foot for securing the running of cars through Trafford Park to Davyhulme, a village near the Ship Canal, which is being rapidly developed.

Edinburgh.—Following suggestions as to the possibility of adapting self-propelled cars to the existing service, Mr. W. A. Stevens, of the Tilling-Stevens Co., makers of the electric 'bus and car, visited Edinburgh last week, and accompanied by the burgh engineer, inspected certain routes. The power stations were also inspected. Later, Mr. Stevens had an interview with Mr. Shepherd, manager, and Mr. Harris, engineer, of the Edinburgh Tramway Co. At a meeting of the Tramway Committee held later in the week, Mr. Stevens stated that there would be no difficulty in applying the self-propelled car to any of the lines in Edinburgh. On the other hand, he was afraid that the Edinburgh cable car could not be adapted to the petrol-electric chassis. That, he explained, would be commercially impracticable. The Committee also discussed the report of the deputation which visited various English towns in connection with the tramway developments.

Greenock.—The Corporation has appointed a deputation to collect information regarding the railless trolley system. The intention is to introduce the system, if it is found suitable, in the upper parts of the town where such facilities are urgently required.

Huddersfield.—The difficulties between the Huddersfield Corporation and the W.R. County Council and the District Councils of Elland and Greetland in regard to the proposed tramway extension from Birchencliffe to West Vale have been overcome. The extension is to be completed within three years, and Long Wall is to be widened to 27 ft. for its whole length. This latter work will cost £1,500, and has been apportioned as follows:—Huddersfield Corporation, £525; W.R. County Council, £525; Elland Council, £325; and Greetland Council, £125.

Hurst.—The U.D.C. has decided, subject to the consent of the B. of T., to grant a lease for five years of the tramways to the Ashton-under-Lyne T.C. It is not intended to reserve any rent by the lease, but the T.C. will covenant to expend £300 on renewing the tramways during the five years, and to pay any part of that sum not actually expended to the U.D.C. at the end of the term.

Glasgow.—The representative of the REVIEW in Glasgow has been favoured with the following official report of the year's working of the T.C.'s Tramways Department :—

		Increase.
Average track mileage open during year (single) ...	194¾	
Car-mileage	23,335,008	899,932
Traffic receipts	£1,007,652	£20,372
Traffic receipts per car-mile ...	10·36d.	dec. ·19d.
Traffic receipts per passenger	·77d.	dec. ·08d.
Passengers carried	311,480,086	35,869,701
Passengers per car-mile ...	13·34	1·06

The following statement gives the number of passengers carried at each fare :—

	May 31*st*, 1913.	*May* 31*st*, 1912.
½d.	191,944,261	121,212,468
1st two-stage	—	9,062,479
2nd do. ...	—	9,058,682
1d.	87,676,208	104,334,320
1½d.... ...	20,354,233	20,337,702
2d.	6,191,033	6,258,659
2½d.... ...	2,761,992	2,736,945
3d.	1,317,543	1,340,308
3½d.... ...	1,076,768	1,109,998
4d.	158,048	158,824
	311,480,086	275,610,385

Leeds.—The Corporation Parliamentary Committee has decided to promote a Bill in the next Session providing for extensions of the tramway and railless traction systems.

The Corporation Tramways Committee has decided to establish ½d. fares on the Headingley, Roundhay and Chapletown routes at the earliest possible moment.

Liverpool.—The Council at its meeting this week will consider a motion as to the practicability of using the tramways for the conveyance of goods to neighbouring towns.

London.—The first of the tramway trailer cars was put into service by the L.C.C. on March 17th, the B. of T. consent being for three months. The Board has now asked for a report on the working of these cars at the expiration of that period, and the Highways Committee being of opinion that experience should be gained in their use over conduit routes of greater length has asked the Board to sanction their being run on the Merton circular route, *via* Tooting, Clapham, and the Victoria Embankment.

In connection with the opening of the Rushey Green and Forest Hill tramway, on May 29th, the L.C.C. allowed the public free rides on that day in order to give publicity to the new route.

A Progressive member of the L.C.C. is urging the desirability of issuing monthly and quarterly season-tickets on the tramways in view of the popularity of return tickets on South London routes.

An article recently appeared in the *Financier* criticising the experimental conversion of three old horse cars for petrol-electric working. The article refers to the success of the Tilling-Stevens petrol-electric motor-'bus, but considers that the experimental tramway car is a patchwork arrangement, which cannot do justice to the petrol-electric plant and system of working. It points out that the petrol consumption is wasteful, viz., 8 miles per gallon, or the same as for a motor-omnibus requiring 300 per cent. more tractive energy per ton. The article concludes that the new car distinctly suggests that it has been a case of "too many cooks," and that this is borne out by the fact that the L.C.C. engineering department appear to have superintended the whole job.

Newcastle-on-Tyne.—At a meeting of the Tramways Committee, on the May 29th, the chairman made his annual statement. He said the year just closed had been one of records in income, expenditure, gross profit, and net surplus. During the year they had taken for traffic £226,281, and for parcels £1,810, a total of £228,091, and an increase over the previous year of £11,500. There had been received for public street lighting £4,619, and for lighting for public buildings £1,007, for advertising on the cars they had received £3,678, and with other items the total income reached £238,204, an increase of £11,570 over the previous year. The traffic expenditure had been £64,493, against £60,663 in the previous year; general expenses totalled £18,674, against £17,730. This increase was largely accounted for by the increase of rates and taxes, and the extra charges for accident and fire insurances. For general repairs and maintenance the expenditure had been £25,943 against £27,122. They had had to pay out of the reserve fund £1,229 for car renewals. On the permanent way they had expended £7,692 against £5,800, the outlay being simply for the repair of streets, and on the electric equipment they had spent £2,088, compared with £3,612. Power expenses had been £11,998 against £9,239, an increase almost wholly due to the late coal strike. The coal bill had been £8,191, as compared with £5,416. During the strike, the Committee secured itself by buying and stocking a very large quantity of coal, and it had to buy it at a considerably enhanced price, which more than doubled the coal bill for the time. The Committee could, however, congratulate itself on the fact that it had always sufficient coal in stock, and was able to keep a full service of cars running without having to shut down a single minute during the whole progress of the strike. After the settlement it had to purchase again at a high price, and for the present year the coal bill was estimated at just about twice the amount it was before the strike, viz., £10,000. During the year, £3,510 had been spent on maintenance and repairs at the power station and the sub-stations. The cost of repairs to steam and electrical plant was also higher owing to increased attention to the machinery necessitated by wear, and here it might be stated that the Committee had placed an order with Messrs. Parsons & Co. for a new turbine. This provision was necessary to meet the peak load. The total working expenditure for the year had been £129,019 against £122,012, and there was a gross profit of £109,184. Out of this there had been paid for interest on loans £30,431 and £39,556 for sinking fund, leaving a surplus for the year of £38,504. Of this sum, £12,000 had been paid to the relief of the rates, and after meeting certain other items there remained £21,189 to go to the reserve and renewal fund, which would make it £119,407. He mentioned that no less a sum than £60,000 was included in this year's estimates for renewals.

Nottingham.—The City Council at its meeting on Monday adopted the annual report of the Tramways Committee. The report showed that the receipts for the year, exclusive of interest on investments, amounted to £167,160, an increase of £4,562. The average per mile was 11·50d., or an increase of ·28d. over the previous year. The working expenses amounted to £108,273 (increase £2,111), leaving a balance of £58,886. This has been disposed of as follows :—To interest on stock and loans, £14,349 ; to repayment of capital, £19,761 ; in aid of district rate, £19,000 ; to reserve and renewals fund, £4,775 ; and to part cost of removal of centre poles in Mansfield Road, £1,000. The increase of expenditure includes £1,340 in wages of traffic staff and £1,128 in maintenance charges. Against this increase is a saving of £1,448 in the reduced consumption of electrical energy. The maintenance charges of £18,683 include £8,517 expended upon cars, £1,305 upon the overhead electrical equipment and £8,361 upon permanent way. A number of new and improved motors have been charged against the reserves and renewal fund, which now stands at £63,744. The cars ran 3,485,789 miles, an increase of 9,527 over the previous year, the result of increased services on two of the busiest routes. The number of passengers carried (38,484,032) was an increase of 2,457,561. There was an increase of 3,008,954 in the number of children's tickets issued. This concession, however, affected the issue of penny tickets, in which there was a decrease of 947,096, as against an increase of 395,713 in those of a higher figure. Ordinary penny tickets formed 74·69 per cent. of the total issued, and the least used were the workmen's 2d. and the ordinary 3½d. ares.

The discussion of the report produced a string of suggestions for the improvement of the undertaking.

In reply, Ald. Radford said the Corporation was applying for powers for railless trolleys in the Bill now before Parliament. It might go on reducing fares until it cut the revenue away altogether. The Committee had considered the question of transfer tickets, but could not see that the thing was practicable with efficient working of the system. "Pay-As-You-Enter" cars would be considered, but the question arose how to prevent the blocking of traffic at busy times. The Committee were unanimous that universal penny fares were not practicable.

The report was adopted.

On the Sherwood section of the Nottingham tramways, work is in progress in the removal of the central trolley wire standards ; with the completion of this work the last remaining centre poles in the city will have disappeared, side poles for the central standards having been substituted along the other routes.

The Corporation has decided to drop all the clauses relating to the running of motor-'buses outside the city in the Bill which it is promoting in the present Session of Parliament. As a consequence of this action the West Bridgford Council's Bill, the object of which is to provide a motor-'bus service for its district, will now be proceeded with. The original proposal in the Corporation's Bill was to run a motor-'bus service from the city through the Bridgford district, also through the urban districts of Carlton and Arnold.

Plymouth.—The solicitor to the London and South-Western Railway Co. has informed the Corporation that Clause 33 of the Bill promoted by the company with respect to road vehicles has been withdrawn. By Clause 33 it was provided that the company may work in connection with, or extension of, their whole railway system, "road vehicles" driven by horse, electrical or any mechanical power, for the conveyance of passengers, luggage, parcels and goods, "whether to and from any of their stations or otherwise." Spirited opposition is responsible for the result stated above.

Salford.—The Council has accepted the offer of the Eccles Corporation to supply current to the Salford tramways in Eccles for a term of five years at 1·125d. per unit for a minimum consumption of 675,000 units per annum, and for all above that quantity at ·75d. per unit. A coal clause is to be inserted in the agreement.

South Shields.—The annual report on the working of the Corporation tramways just issued, shows that the net profit of £6,318 creates a record, being an increase of £654 on the previous year. The total revenue was £34,151, an increase of £1,219. The receipts averaged 10·06d. per car-mile, as against 9·71d. in the previous year. The working expenses show a slight increase—£19,221, as against £18,426, or 5·66d. per car-mile, against 5·44d. in the preceding 12 months. This increase is principally due to advances of employés' wages, and payment under the Insurance Act, the maintenance costs being practically the same as last year. Out of the gross profit of £14,930, £8,612 was paid for interest and sinking fund. The practice of the tramways department in carrying on its own insurance has amply justified itself, the total amount paid in accident claims being £497, which included the costs of a case carried into court. The profit on carrying 68,000 parcels was £284.

Sunderland.—The manager of the Corporation tramways (Mr. A. R. Dayson) has reported to the Tramways Committee upon the request of the Sunderland District Tramways Co. for running powers over the Corporation's lines from Grangetown to the centre of the town. The Committee agreed that such powers are desirable, and has consented to grant them, providing it has power to do so, upon conditions to be mutually agreed upon.

Walthamstow. — Notice of objection is to be drawn against the assessment of the tramways undertaking; a special Committee is to consider the reorganisation of the staff and employés in the tramway department.

West Hartlepool.—At a special meeting of the T.C. on May 29th, Alderman Suggitt moved a resolution authorising application to the Light Railway Commissioners for an order under the 1896 Act, amending the West Hartlepool Light Railway Order, 1897, with the object of assuring for the Corporation further powers with reference to the borrowing of money, &c. It was explained that with respect to the purchase of the tramways by the Corporation it had the necessary powers for all sections with the exception of the Seaton Carew section which was constructed under the Light Railways Act. It was, therefore, necessary to obtain those powers by an amendment of the order. The resolution was adopted.

TELEGRAPH and TELEPHONE NOTES.

Greece.—A Bill has been introduced into Parliament sanctioning an outlay of 1½ million francs for the purpose of extending the telegraph and telephone networks.

Imperial Wireless System. — The Select Committee on the Marconi Contract sat on Monday and yesterday to consider the chairman's draft report on the rumours regarding the dealings of Ministers in shares. The *Times* states that alternative reports were put forward by the Unionist and Liberal members respectively, treating the question on party lines.

Libel Action.—The action for libel brought against Mr. C. Chesterton by Mr. Godfrey Isaacs was still in progress yesterday. Last week Mr. Samuel and a number of official witnesses were examined as to the course of the negotiations between the Post Office and the Marconi Co. Sir Rufus Isaacs was then called, and in the course of cross-examination, stated that the facts regarding his purchase of shares of the American Marconi Co., and his dealings with Mr. Lloyd George, were privately communicated by him to Mr. Falconer and Mr. Booth, members of the Select Committee of the House of Commons, before the journalists were examined by the Committee. [It will be remembered that the Committee, by a majority vote, refused to allow the witness to answer a question as to whether any of the Committee had received private information of this nature.] Mr. Godfrey Isaacs was next examined and described the negotiations with the Post Office. He stated that at present the company had 1,600 telegraph stations on board merchant ships. There were also installations on board some ships and on board men-of-war which were not managed by the company. The company had supplied 163 military field stations and 200 or 300 land stations. The company employed about 200 skilled engineers, and the total number of employés was about 3,000. All the £250,000 7 per cent. preference shares were now issued. In addition to the £500,000 ordinary shares, £250,000 ordinary shares were created in October, 1911, and the subscribed capital of the company was now £1,000,000. The company was incorporated in 1897, and down to the beginning of 1910 no dividend was paid. The preference shares were created in 1908, and the first dividend on them was paid in 1910. On September 1st, 1911, an interim dividend of 5 per cent. was paid on the ordinary shares, and the dividend for the year on the ordinary shares was 20 per cent. From 1910 down to 1912 the business of the company increased very largely. In July, 1911, the contracts in hand amounted to about £250,000, and in July, 1912, they amounted to about a million sterling. The latter sum included the Post Office contract, which amounted to £360,000—six stations at £60,000 a station. After the declaration of a dividend in August, 1910, the value of the Marconi ordinary shares began steadily to rise.

Mr. Isaacs was cross-examined with regard to companies with which he had been previously connected, and stated that he had never received any complaint from any shareholder or from his co-directors in respect of any of those companies. The Judge repeatedly intervened to check the cross-examining counsel.

On Monday Mr. Isaacs's examination was concluded, and on Tuesday Mr. Marconi was the principal witness; he expressed the greatest confidence in the ability and integrity of Mr. Isaacs, and similar evidence was given by former colleagues of the latter. The case for the defence was then opened.

Loaded Telephone Lines.—According to the *Journal Télégraphique*, the longest line in Europe provided with Pupin loading coils is that between Stockholm and Lulea, 1,299½ km. in length. The Pupinised line between Berlin and Aix-la-Chapelle is almost 700 km. long.

Norway.—A submarine bell has been placed at Lille Faerder, at the entrance to Christiania Fjord. The bell is worked by electricity.

Nose Telephone.—A new telephone transmitter has been devised by Dr. Jules Glover, with a nose-piece intended to catch the nasal sounds which occur so frequently in the French language, for example, and which are lost when the ordinary mouthpiece is used alone.

Telephone Cable from Dublin to Holyhead.—The telephone trunk line connecting the General Post Office, Dublin, with the new cable which crosses from Holyhead to Howth has now been completed. The wires are carried on high standards, which have been set at some distance from those of the Tramway Co. The standards, instead of being placed on the road, have been erected on concrete foundations in the sea along the edge of the harbour, and are carried thence on the western side of the railway line to the city.

Wireless Service between Germany and America.—Experiments have been made since the end of January last between the Telefunken station at Nauen, near Berlin, and the station at Sayville, Long Island, which is owned by the Atlantic Communication Co., of New York. These experiments have given satisfactory results, and have, for the first time since the inception of wireless telegraphy, allowed radio-telegraphic messages to be sent across the ocean on the route, New York-Berlin. The distance bridged in this connection works out at about 6,500 km., whereas the distance between Ireland and Canada, where a Marconi service has for some years been in operation, is only about 3,200 km. The experiments above referred to are being continued with a view to collecting all necessary data for establishing a regular radio-telegraphic service. We are not informed whether the communication is effective during daylight hours.

Wireless Telephony.—A record in telephony is claimed to have been accomplished by the Telefunken Co., of Berlin, in connection with the experimental station at Nauen by the use of the company's high-frequency machine for the production of sparkless oscillations, in conjunction with a new method of switch arrangement. Having previously notified various receiving stations of the intention, extracts from newspaper articles were recently read aloud at the Nauen station, and are said to have been transmitted distances of from 370 to 430 miles, as, for instance, to the Vienna Technological Museum, where they were perfectly understood by Prof. Kann.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—The electrical engineer has been instructed to prepare specifications and obtain tenders for the work of replacing 14 carbon arc lamps in the Market Hall by 20 200-C.P. Osram lamps.

Atherton.—June 10th. Two 150-KW. single-phase transformers, for the U.D.C. See "Official Notices" May 30th.

June 11th.—Contract No. 1: Sub-station buildings; No. 2: extra-high-tension, high-tension and low-tension switchboards and transformers; No. 3: mains. W. Garnett, Clerk to U.D.C., Town Hall.

Australia.—VICTORIA.—June 11th. Switchgear and instruments, for the Melbourne City Council. See "Official Notices" April 25th.

June 24th.—H.D. copper wire, telephone parts and telephones, for the P.M.G. See "Official Notices" May 23rd.

July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" May 23rd.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" May 30th.

TASMANIA.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" May 23rd.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA. — July 9th and 30th and August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

June 11th. Metal-filament lamps, for the P.M.G. See "Official Notices" May 23rd.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" to-day.

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" to-day.

SOUTH AUSTRALIA.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

NEW SOUTH WALES.—July 9th. Switchboards, for the P.M.G. See "Official Notices" May 30th.

Austria.—June 13th. The Austrian State Railway authorities in Vienna are inviting tenders for an electric power installation at the Railway boiler works at Simmering.

Belgium.—June 14th. The Belgian Telegraph authorities, at La Salle Madelaine, Brussels, are inviting tenders for 5,234 metres of telegraph cables, with accessories.

Brazil.—June 23rd. Tenders will be received for the establishment of rubber-refining works (1) in Manaos, capital of the State of Amazone; (2) and in the States of Piauhy, Ceara, Rio Grande do Norte, Pernambuco, Bahia and Sâo Paulo: and (3) for the manufacture of rubber goods in the towns of Manaos, Belen do Para, Recife and Bahia. Particulars from the Bureau de Renseignements die Brésil, 59, Rue Richelieu, Paris.

Chile.—September 10th. According to an advertisement in the *Times*, tenders are invited for the establishment of a "thermo-electric central station and distribution of electric energy at the port of Valparaiso." Particulars, &c., can be obtained at the offices of the Chilean Legation, 48, Grosvenor Square, W. Tenders to Offices of Ports Commission, Santiago.

France.—NEVERS.—August 31st. The city of Nevers has opened a competition with a view to the supply and installation of a water-hoisting system at the new waterworks. Steam, suction gas or electric motor systems may be submitted, the power required being equal to raising normally 120 litres of water to a height of 72·30 metres actual. Particulars and plans from M. Huet, Ingenieur en Chefs des Ponts et Chaussées, 2, Rue de la Poissonnerie, Nevers.

Germany.—July 3rd. The Prussian State Railway authorities (Maschinen-Amt, 2) at Bremen, are inviting tenders for two electrically-operated coal-loading cranes.

Halifax.—June 6th. One natural draught chimney type water cooling tower, for the Electricity Department. See "Official Notices" May 23rd.

Hungary.—June 15th. The municipal authorities of Torokbecse are inviting tenders for the concession for the public and private electric lighting of the town. Deposit 5,000 kronen. Particulars from the Gemeinde Notarsamt, Torokbecse, Hungary.

MAROJUSVAR.—June 15th. Tenders are invited for the supply and erection of an electric lighting installation at the Royal Salt Mines at Torda. Particulars of the K. Ung. Oberbergamt, Marojusvar, Hungary.

Leyton.—June 24th. Electric lighting and hot-water heating for the new Church Road Schools, for the U.D.C. See "Official Notices" to-day.

London.—ST. PANCRAS.—June 9th. Welsh and other steam coal for the Electricity Department, 57, Pratt Street, N.W.

L.C.C.—June 24th. One 50-ton overhead travelling crane for Greenwich generating station. See "Official Notices" to-day.

June 25th.—Electrical installation at Randall Place Elementary School, Greenwich, S.E. See "Official Notices" to-day.

HAMMERSMITH.—June 18th. Air-cooled static transformers, for the Borough Council. See "Official Notices" to-day.

SOUTHWARK.—June 11th. Supply of cable for 12 months, for the Borough Council. See "Official Notices" to-day.

Manchester.—June 7th. The Electricity Committee invites tenders for the supply of stores required during the 12 months ended June 30th, 1914. Particulars and forms of tender from Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

Newcastle-under-Lyme.—June 21st. Supply and laying of cables, for the Corporation. See "Official Notices" to-day.

Newport (Mon.).—July 1st. Refuse destructor for the T.C. Borough Engineer, Town Hall.

Portsmouth.—June 11th. Wiring for electric light installation at Workhouse Infirmary extensions, &c., Milton. See "Official Notices" May 16th.

Rawtenstall.—June 10th. One 1,500-KW. turbo-alternator complete with condenser, for the Corporation. See "Official Notices" May 23rd.

South Africa.—WELLINGTON (CAPE PROVINCE).—Tenders are called for an electric lighting installation for the municipality comprising two 70-B H.P. suction gas engines and producers (or, as an alternative, superheated steam engines), two 48-KW. three-wire dynamos, one 10-KW. motor-balancer, and one three-wire battery booster set, battery and distilling plant, switchboard, poles, copper, insulators, feeder pillars, travelling crane, meters, instruments, &c., also for erection, overhead equipment, &c. Specifications on deposit of certified cheque for 10 guineas, payable to the order of the Town Clerk, Wellington, from Mr. Chas. G. Trevett, consulting engineer, 70, Fletcher's Chambers, Cape Town.

Southampton.—June 19th. Electric lighting of the old pavilions at the Infirmary, Shirley Warren. See "Official Notices" May 30th.

Spain.—June 16th. The municipal authorities of Montalban (province of Cordoba) are inviting tenders for the concession for the electric lighting of the town during a period of 13 years.

Stalybridge.—June 7th. Engine fuel and stores for the Joint Tramways and Electricity Board for 12 months, commencing July 1st next. Specification, &c., obtainable from Mr. R. Blackmore, Engineer-in-Chief, Generating Station, Stalybridge.

Swansea.—June 6th. Installation of electric light and bells at the new training college, Glanmor, for the Education Committee. See "Official Notices" May 23rd.

Swindon.—June 23rd. Cooling tower, water softening plant and flanged cast-iron piping, for the Electricity Department. See "Official Notices" to-day.

West Hartlepool.—June 14th. Two 300-KW. rotary converters, complete with transformers, switchgear, &c., for the Corporation. See "Official Notices" May 30th.

CLOSED.

Belgium.—Two tenders were submitted to the Société du Canal et des Installations Maritimes de Bruxelles for the supply of five electrically-operated 3-ton cranes for the loading of steamers on the Brussels Ship Canal, the lowest being that of the Société des Ateliers de Constructions Electriques, of Charleroi.

Bennis Contracts.—The following contracts have been received by Messrs. E. Bennis & Co., Ltd.:—

Rawtenstall Corporation electricity station.—Two stokers and self-cleaning compressed-air furnaces (repeat order).
Rochdale Corporation electricity works.—Four chain-grate stokers.
British Insulated & Helsby Cables, Ltd., Prescot.—One chain-grate stoker (repeat order).

Bolton.—The Tramways Committee has accepted the tender of Mr. T. W. Ward, Sheffield, for 150 tons of old rails, and that of Messrs. Todd Bros., St. Helens, for 50 tons.

The Electricity Committee has accepted the following tenders:—

B.I. & Helsby Cables, Ltd.—Cables.
Doulton & Co.—Conduits.
T. Wragg & Sons.—Conduits.

Brighton.—The Lighting Committee of the T.C. has accepted the tender of Messrs. Gardner, Locket & Hinton, Ltd., for not less than 40,000 tons, or more than 48,000 tons of Grangerigg washed nuts for the Southwick electricity works for two years, at 16s. 5d. per ton.

Coventry.—The T.C. has accepted the tender of Messrs. Edgar Allen & Co., Ltd., for a track lay-out at the car-shed of manganese steel, at £315; and that of Messrs. Shaw & Nicholas, for the erection of a car-shed, at £3,838.

Derby.—The E.L. Committee of the T.C. has accepted the tender of Messrs. Newton Bros. for a motor-alternator, at £1,835, and that of Messrs. Greaves & Co. for chains for the coal elevator and conveyor, at £54.

The Tramways Committee has accepted the tender of the Brush Electrical Engineering Co., Ltd., for five roof covers for tramcars, at £548.

Eccles.—The T.C. has accepted the tender of Thos. Beeley & Son, Ltd., for a Lancashire boiler at the electricity station.

Harrogate.—The T.C. has accepted the tender of Messrs. Ferranti, Ltd., for switchboard extensions for the new generating plant, at £195.

Hull.—The City Education Committee has accepted the tender of Messrs. J. Walsh, Ltd., for installing electric light at Saner Street Schools, at £271.

Leeds.—The Tramways Committee of the T.C. has accepted the tender of Messrs. Wm. Airey & Son, for the erection of a tramway shed, depôt and workshop offices at Sovereign Street, at £22,199.

Liverpool.—The T.C. has accepted the following tenders:—

National Steam Car Co., Ltd.—Motor chassis for the Tramways Department.
Pope's Electric Lamp Co., Ltd.—Annual supply of 40-watt and 60-watt metallic-filament lamps.
J. Hunter & Son, Ltd.—About 8,000 yd. of worsted serge for use in the Tramways and Electricity Departments.

London.—LEYTON.—The U.D.C. has received the following tenders for the supply of cable for the new feeder to Leigh Road:—

R. R. Todd	(accepted) £1,719
Standard Cable Co., Ltd.	1,797
Western Electric Co., Ltd.	1,820
B.I. and Helsby Cables, Ltd.	1,827
Siemens Bros. & Co., Ltd.	1,827
W. T. Henley's T.W. Co., Ltd.	1,860
Glover & Co., Ltd.	1,860
Johnson & Phillips, Ltd.	1,900
Electrical Engineering and Equipment Co.	1,934
Callender's Cable Co., Ltd.	1,982
General Electric Co., Ltd.	2,040
Pirelli, Ltd.	2,088
Union Cable Co., Ltd.	2,168
General Cable Manufacturing Co.	2,170
Connolly Bros.	2,350

Tenders for annual supplies of meters have been accepted from Venner & Co., Electrical Apparatus Co., B T.H. Co., B.I. and Helsby Cables, Ltd.

The quotation of the British Westinghouse Electric and Manufacturing Co., Ltd., has been accepted, at £46 10s., for a spare armature for two 25-H.P. fan motors, and, at £21, for a spare armature for two 8-H.P. machines.

MARYLEBONE.—The following tenders have been accepted by the B.C. for supplies to the electricity department:—

Flexible cords.—Pirelli, Ltd.; Armorduct Manufacturing Co.
Carbon brushes.—Le Carbone, Ltd.
Box compound.—The Dussek Co.
Rubber insertion.—North British Rubber Co.
Para strip and black tape.—Siemens Bros.
White Silesian tape.—J. North Hardy & Co.
Fireproof tape.—Siemens Bros.
Rubber mats and manhole rings.—Messrs. Ingram.

The tender of Herbert Morris, Ltd., has also been accepted, at £400, for four 10-ton travelling cranes at the Aybrook Street sub-station.

The Local Government Records and Museums Committee received the following tenders for electric lighting installation at Geffrye's Almshouses, Shoreditch, which buildings are now being adapted for museum purposes:—

W. C. Tackley & Co., Ltd.	(recommended) £113
R. H. & J. Pearson, Ltd.	119
Cunningham, Ltd.	134
G. Weston & Sons, Ltd.	149
E. Lawrance & Sons, Ltd.	161
C. H. Cathcart & Co.	225

L.C.C.—The Highways Committee received tenders, as below, for (1) slot rails and conductor tees; (2) track rails and fastenings; (3) special track rails, renewable guards and fastenings, for the tramways:—

(1)

Frodingham Iron and Steel Co.	(recommended) £19,812
John Batt & Co., Ltd.	15,711
Walter Scott, Ltd.	16,566

Chief Engineer's estimate, £15,875.

(2)

	Carbon steel.	High silicon steel (Sandberg process).
A. W. Nye (Société Anonyme d'Ougrée-Marihaye, Belgium) (fish bolts not quoted for) ..	£19,930	—
Bolckow, Vaughan & Co., Ltd.	24,322	£25,072 (recommended)
J. Batt & Co. (London), Ltd.	24,470	25 599
Walter Scott, Ltd.	24,512	26,012
A. Brown & Co. (Soc. Anon. des Acieries d'Angleur, Belgium)	26,892	27,340
Barrow Hæmatite Steel Co., Ltd.	26,526	(no tender)
Cammell, Laird & Co., Ltd.	(fish-plates only quoted for)	

(3)

Bolckow, Vaughan & Co., Ltd.	£17,014
Barrow Hæmatite Steel Co. (no bolts quoted) ..	17,441
J. Batt & Co., Ltd.	18,504
Walter Scott, Ltd.	19,481

£17,476 (recommended)
(no tender)
19,197
20,406

For an overhead travelling crane for the permanent way depôt, Leven Road, Poplar, the tenders received were:—

J. Spencer & Co., Ltd.	(recommended) £72
Higginbottom & Mannock	84
Thos. Smith & Sons	90
East Ferry Road Engineering Works Co., Ltd.	107

The Committee has extended for a year contracts with the Morgan Crucible Co, Ltd, the Sloan Electrical Co., Ltd., and Messrs. W. Geipel & Co., for carbon traction motor and other brushes for electrical machinery.

BERMONDSEY.—The B.C. received tenders for time switches from the Adnil Electric Co., the Bat Meter Co., G. Braulik, Chamberlain and Hookham, Ferranti, W. Geipel & Co., Landis & Gyr, Reason Manufacturing Co., Siemens Bros. Dynamo Works, and Veritys, Ltd. The offer of the Reason Co. was accepted.

Maidstone.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for a year's supply of coal as follows:—Northumberland rough, 16s. 6d. per ton; Yorkshire house screenings, 18s. 6d. per ton.

Newport (Mon.).—At a recent meeting of the Electricity Committee, tenders for a turbo-alternator and for a 600-KW. D.C. generator were considered, and after careful consideration of a report of the tenders (prepared by the borough electrical engineer, Mr. A. Nichols Moore), the Committee recommended for acceptance the tender of the A.E.G. Electric Co., Ltd., for a 3,000-KW. turbo-alternator, and that of the Lancashire Dynamo Co. for a 600-KW. D.C. generator. We understand that in the case of the turbo-alternator the accepted tender was the most favourable and advantageous, the price being approximately £1,000 lower than that of any English tenderer, and earlier delivery was guaranteed. The steam consumption guaranteed was also lower.

According to the discussion which took place at the special Council meeting on Tuesday, as reported in the *Times*, Mr. John Moxon, the chairman of the Electricity Committee, said that they had no option but to ask the Council to go outside the country for the bigger plant. There were 36 tenderers for the turbo-generator, and 28 for the direct-current generator. No English firm came anywhere near the price quoted by the German firm. It was unfortunate to have to go out of the country, but they as a Corporation could not afford to be philanthropists. The matter of the Germans being able to supply at a lower cost than that of British manufactures was explained by the existence in Germany of a "common good fund," provided jointly by the manufacturers and the State, to recoup any loss a manufacturer may sustain in such a contract. Another point was that the English firms had modified the contract conditions set down by the Corporation, and no English firm could carry out the whole of the work. If the contract was let to English manufacturers, it would mean that the Council would have to deal with three firms, and they had had some experience in the matter of dividing responsibility in such cases.

In the speech of Mr. Robjent, as reported in the *Monmouthshire Evening Post*, this gentleman said that as a member of the Committee he did not consent to the main contract going out of the United Kingdom. The loss of wages to our workpeople, compared with the small capital cost saving, was a weighty argument against acceptance of the tender. While the British manufacturers had combined together and inserted in their tenders certain conditions, which were not conditions acceptable to the Committee, on the other hand, the German firm had practically accepted the whole of the conditions the borough electrical engineer put forward. A good many things had happened since that time. The English manufacturers had been given to understand the position, and the result had been that they agreed to the whole of their conditions, and at the present moment they compared, to all intents and purposes, with the German manufacturer. They had modified very considerably their tenders, and whilst the A.E.G. Co. had imposed fresh conditions, the English manufacturers had come down.

Nuneaton.—The T.C. has accepted the tender of Messrs. W. Lucy & Co., Ltd., for 25 street lamp brackets, at 14s. 6d. each.

Salford.—The following tenders have been accepted by the T.C.:—

J. Gerrard & Sons, Ltd.—Erection of new extra-high-tension switch-house and foundations at the Frederick Road electricity station, £997.
Bertram Thomas.—Copper strip for main lighting and power switchboard. £302.
British Thomson-Houston Co., Ltd.—Switchgear required for the bulk supply meter house of the Lancs. Electric Power Co., £1,352.
Bell Bros.—Annual supply of natural black oil, 1s. 1d. per gallon.

South America.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract for the supply of "Wotan" pure-drawn tungsten wire lamps for a large town in South America. The lamps, which have just been dispatched from their Shacklewell Lane stores, are mainly intended for street lighting. The total number of lamps for the consignment is 36,100, and the total C.P. 2,117,000. The highest C.P. lamp employed will be 400, and the lowest 16. These lamps are for a circuit voltage of 200. "Wotan" lamps were decided upon after exhaustive tests.

Southampton.—The following tenders were received by the T.C. for the installation of electric light at the Regent's Park School:—

L. Groves & Co.	(accepted) £121
F. W. Cook & Co.	175
J. Davis & Co.	185
A. Kingman & Co.	189
W. Dibben & Sons	265

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturday, June 7th.—At 3 p.m. Lecture on "Radioactivity; The Radioactive State of the Earth and Atmosphere," by Prof. E. Rutherford.

Salford Technical and Engineering Association.—Wednesday evening, June 11th. Visit to Pollock & McNab, Ltd., Britannia Machine Tool Works, Bredbury.

British Engineers' Association.—Thursday, June 12th. At 2.15 p.m. At Institution Rooms, 200, Buchanan Street, Glasgow. Meeting, Mr. T. C. Stewart presiding. Addresses by Captain T. C. FitzHugh and others on "China."

Tramway and Light Railway Association.—Thursday and Friday, June 12th and 13th. At Blackpool. Annual Conference. The papers to be read are as follows:—"Possibilities for Increasing Profits on Interurban Lines," by E. H. Edwardes; "Tramways—a Résumé," by F. Bland; "Railless Traction and Motor-'Buses," by H. England; "Standard Rules for Motormen and Conductors," by A. V. Mason.

Physical Society.—Friday, June 13th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Experiments on Tinfoil Contact with Dielectrics," by G. E. Bairsto. Paper on "A Method of Measuring the Pressure of Light by Means of Metal Foil," by G. D. West.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, June 9th.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 6th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.

Tuesday, June 10th.—"B" Company. Ditto.

Thursday, June 12th.—"C" Company. Ditto.

Friday, June 13th.—"D" Company. Ditto.

Saturday, June 14th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. to 12 noon.

(Signed) J. H. S. PHILLIPS, Major, L.E.E.
For Officer commanding L.E.E.

NOTES.

Wanted—Five Hundred Pounds.—Our readers will have noticed that an invitation has been given in several issues of the ELECTRICAL REVIEW for six gentlemen or firms to subscribe £100 apiece so as to enable the Electrical Trades Benevolent Institution to take advantage of Mr. E. G. Byng's offer of £100, provided nine other offers were forthcoming within three months from April 16th. Last week we omitted the notice with a feeling of disappointment that generously-minded men were of so very retiring a disposition, but we are only too glad to publish the table again this week, for the fifth hundred pounds has come along from the kindly heart of a veteran of the industry. Sir William H. Preece, K.C.B., F.R.S., in his advancing years, has shown his desire to assist the Institution of which he has for a number of years been president, and his name accordingly appears below. Five spaces still remain open, and once again we renew our appeal to the large-hearted to 'phone or write to the secretary, or to us, under the first impulse that possesses them after reading this note. Maybe there are some whose nature it is to shrink from publication of their gifts of charity. To such we would put it that the effect of their example might be rightly to influence others, but we would also add that there is always the alternative of anonymity. So long as the money is brought to the coffers of the fund, so as to be available for ameliorating the lot of the needy sons and daughters of the electrical industry, what matters it whether the hundred pounds be by name or anonymously? The position now stands as follows:—

1	Mr. E. G. Byng	£100
2	Mr. G. Sutton	£100
3	Mr. H. Hirst	£100
4	Mr. E. Garcke	£100
5	Sir W. H. Preece, K.C.B., F.R.S.	£100
6	*	
7	*	
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Electrical Contractors' Dinner.—The annual dinner of the Electrical Contractors' Association, Inc., will be held on Tuesday, June 17th, at Frascati's Restaurant.

The B.E.A.M.A.—The following firms have been elected "Members" of the British Electrical and Allied Manufacturers' Association:—

The Wilson-Wolf Engineering Co., Ltd.
Tilghman's Patent Sand Blast Co., Ltd.

The following firm has been elected an Associate:—

Maschinenfabrik Augsburg-Nurnberg A.G.

Institution and Lecture Notes.—JUNIOR INSTITUTION OF ENGINEERS.—On June 30th, at 8 p.m., at the Institution of Electrical Engineers, Victoria Embankment, the Gustave Canet Lecture on "The Working Fluid of Internal Combustion Engines" will be delivered by Dr. Dugald Clerk, F.R.S. Tickets may be had on application to the Secretary, 39, Victoria Street, S.W. Also at 8 p.m., at the Great Western Hotel, Birmingham, Dr. Dugald Clerk's lecture will be delivered before the Midland Section by Mr. A. A. Remington. Tickets may be had on application to 60, Anderton Park Road, Moseley, Birmingham. From July 4th to 7th the Institution week-end visit to Ghent Exhibition will take place.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting on May 30th, the Report of the Council was adopted, and it was announced that the following gentlemen had been elected to the Council, the list of Members being, otherwise, as given in our issue of April 4th:—Ordinary Member of Council (one vacancy) Mr. R. A. Chattock; Associate Members (three vacancies), Mr. F. E. Berry, Capt. Henrici and Mr. A. W. Martin; Associates (two vacancies), Mr. E. R. Clarke and Mr. A. M. J. Ogilvie.

MUNICIPAL TRAMWAYS ASSOCIATION (INC.).—A meeting of the Managers' Section opened yesterday (Thursday morning) at the Town Hall, Sunderland. After the usual Corporation welcome, there were discussions on the following subjects:—"Description of Sunderland Corporation Tramways System," by Mr. A. R. Dayson; "Interim Report of Rail Corrugation Committee," introduced by Mr. R. H. Wilkinson. After luncheon at the Town Hall, the party went by steamer to South Shields. To-day, again at Sunderland, the following subjects will be introduced for discussion:—"Petrol and Trackless Trolley Vehicles," by Mr. C. J. Spencer; "Standardisation of Specifications for Tramcar Equipments," by Mr. J. W. Hawe.

"Increased Powers" Bill.—We read in the *Times* that on Wednesday afternoon Sir Howell Davies (Bristol) presented a Bill to give increased powers to local authorities with regard to electric lighting and other purposes connected therewith.

Damages Against the L.C.C.—The L.C.C. was, on May 29th, sued in the King's Bench Division for damages before Mr. Justice Bankes and a common jury, for the loss of a husband. The action was brought by the widow, Mrs. Lilian Phyllis Cobbett, on her own behalf and on behalf of her two young children. The deceased man was driving a horse and cart at Lower Tooting, and he turned off the tramline, the wheel of his cart caught in the rails, with the result that he was thrown out, run over and killed. The accident, it was said, arose from the fact that the rails were much worn, and that the guard rail was, in consequence, ¼ in. above the other side of the rail. The jury awarded the plaintiff damages to the amount of £500.

Appointments Vacant.—Assistant to the County Electrician, Middlesex Education Committee (42s.); Showroom attendant for the Torquay borough electricity department. See our advertisement pages to-day.

Bombardment at Earl's Court.—We think we can say with little hesitation that the Imperial Services Exhibition at Earl's Court, which was opened by the Duke of Connaught on Saturday last, will be very popular during the coming months. We do not now refer so much to the exhibits themselves, as these we have not yet closely examined, but we are very much mistaken if the performance or display of naval and aerial warfare in the Empress Hall is not going to "take" with the public in these days of boy scouts and of increased feelings of personal responsibility in the matter of national defence and self-preservation. The spectator witnesses an attack on a fortified coast town by a number of warships, some of 19 ft. and others 30 ft. length, which are models of modern vessels in our fleet to-day. The models were built by Messrs. Bassett-Lowke, Ltd., at Northampton, and they are operated by a couple of men by means of a 1½-H.P. electric motor of special design and a battery of 28 Premier cells. The public will be able to have their heart's content of thrill and noise, as the forts are attacked and respond, as the city is fired, and after a more or less stout resistance shows the white flag—all in a matter of a comparatively few minutes—quickly almost as a cinematograph film tells its story. The interest of the display is added to by the control by the Raymond Phillips wireless system of a 22-ft. airship which manœuvres over the scene prior to the conflict. There were whispers of bomb-dropping from the said airship and of submarine mines in the lake, but these were were not in evidence on the occasion of a preliminary Press view at which we were privileged to be present. However, there was quite sufficient to convince us of the popular appeal which such a demonstration is likely to make. The show is well worth seeing.

Copper. — Messrs. Merton's monthly circular for May shows considerable activity in the market for this metal, the total deliveries (Europe) reaching the extraordinarily high figure of 61,020 tons. The drop in visible supplies, however, only shows as 833 tons, the decrease in English stocks of 1,240 tons being largely compensated for by increase in French stocks and quantities afloat. The decrease in total European stocks is heavier, the drop (when including Rotterdam, Hamburg and Bremen stocks, and quantities estimated for other ports) being 4,141 tons.

Supplies to Europe from North America are considerably above the average. Spain and Portugal send a small quantity to England and France. Chile shipments are rather low, and Australian not up to average. The drop in American visible supplies during April was 12,822 tons, a large quantity, and the decrease in the world's visible supply (including Holland and Germany) was 14,068 tons.

Celluloid Regulations Bills.—With reference to our recent comments by way of criticism of the two Bills in which unreasonable provisions were set forth for the control of premises containing small quantities of celluloid, it is satisfactory to note that the City of London Celluloid Regulations Bill was thrown out on the second reading on Wednesday last week. The House divided on Mr. Baird's motion for the rejection of the Bill, and the voting was as follows:—For the rejection, 127; against, 47; majority for the rejection, 80. The London County Council then withdrew the celluloid part of its Bill. We believe our readers will agree with us that this is a very satisfactory climax to a piece of unnecessary and grandmotherly legislation. Mr. T. R. Brooke, of the British Xylonite Co., Ltd., and others who took early and energetic measures in connection with this matter are to be congratulated.

More Strikes.—We seem to be again in the midst of wars and rumours of wars in the industrial world. In the Midlands a wide-spread strike is in progress, involving the Metropolitan Amalgamated Railway Carriage and Finance Co., the Midland Carriage Works, and some hundreds of men employed by the General Electric Co., Ltd., at Witton. The trouble at Stewarts & Lloyds, Ltd., is still in progress, though a conference between the men and the directors is proceeding. At Bedford there has been a strike of girls employed by Cryselco, Ltd., but all is now normal.

The Bolton Vacancy.—In regard to the vacancy created by the resignation of Mr. A. A. Day, borough electrical engineer and tramways manager at Bolton, the Corporation Tramways Committee has appointed a sub-committee to confer with the Electricity Committee as to the best way of filling the office.

Colliery Fatality.—Mr. G. C. Lewis, coroner, has held an inquiry at Old Hill respecting the death of Albert Priest, who was killed at the Fly Colliery, Old Hill, the previous Tuesday. The evidence adduced showed that the deceased had been putting a piece of wood behind the electric cable, which it would be necessary for him to move; and George Hickman, a loader, found him hanging by three electric wires, which he had hold of with both hands. The electrician at the mine said the cables were supported by string and protected by rubber; he was of opinion that the cable had been stripped by the weight on the timber. The jury returned a verdict that death was due to electric shock, and expressed the opinion that some better method of protecting the cables should be adopted in the future.

(*Continued on page* 946.)

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TWO NEW MEMBERS OF PARLIAMENT.

WE count ourselves happily placed in being able to look at Parliamentary elections from a detached point of view. With party politics in the generally accepted sense we, as a journal, have nothing to do, though we have occasionally

Photo by] *[Lafayette.*

MR. C. G. C. HAMILTON, M.P.

felt it our duty to state our views upon legislative questions. This has not been done with any desire to contribute to party controversies, but with the hope that we might afford assistance in the consideration of questions affecting electrical and engineering industries and the labour and other problems with which all concerned in those industries have been faced. When, therefore, we express satisfaction at the result of certain recent by-elections, it need not be inferred that we are glorying in the success of one party over the other. As we indicate in our leading article to-day, we welcome the return of Mr. J. C. Denison-Pender and Mr. G. C. Hamilton to the Parliamentary councils of the nation, not so much as the Members for Newmarket and Altrincham respectively, as because of their specialised experience in fields of scientific application and industry that the ELECTRICAL REVIEW represents. Both of these gentlemen are by training and experience well qualified to overwatch the interests of the engineering profession and industry, which have down to the present had far too few spokesmen at St. Stephens. Both are young men, comparatively speaking, and an interesting coincidence is that both were married in 1906, and each of them has one son and one daughter.

Mr. Collingwood George Clements Hamilton, M.P. for Altrincham, is the youngest son of the late Ven. George Hans Hamilton, Archdeacon of Northumberland and Canon of Durham, by his marriage with Lady Louisa Frances Clements, sister of the fourth Earl of Leitrim. He was born at Eglingham, Northumberland, in 1878, and is accordingly 35 years of age. Educated at Aysgarth School, Yorkshire, and at Charterhouse, he entered upon the career which gives him a claim upon our attention in this journal, for he served with Messrs. Ernest Scott & Mountain, Ltd., the Newcastle-on-Tyne firm who for so long a period held a front-rank place among engineering concerns engaged in electrical and mining installation work. In these days, when we are all saying so much about the necessity of foreign travel for electrical engineering men, and, indeed, when prominent after-dinner speakers are expatiating upon the importance of more trips abroad by Ministers, it is interesting to note that Mr. Hamilton saw "active service" for the firm with which he was apprenticed, in India, Egypt, Bulgaria, Greece and Russia. He is now joint managing director with Mr. B. M. Drake, of the well-known electrical firm of Drake & Gorham, Ltd., of London, Manchester, &c. He is chairman of the Knutsford Conservative Club, and a member of the Knutsford Urban District Council.

Mr. John Cuthbert Denison Denison-Pender, the new member for Newmarket, is the eldest son of Sir J. Denison-Pender, K.C.M.G., and Lady Denison-Pender. Born in 1882, he is 31 years of age. After his education at Eton, he passed through the numerous branches of the Eastern Telegraph Co., including important cable-laying operations, and he is to-day a director of the Eastern Telegraph Co., Ltd., the Eastern and South African Telegraph Co., Ltd., and the West African Telegraph Co., Ltd.

Mr. Denison-Pender is a grandson of the late Sir John Pender, who was one of the pioneers of submarine telegraphy, and who represented the Wick Burghs as a Liberal in 1883, and retained his seat as a Liberal Unionist in 1886 after the Home Rule split. He is also a nephew of Sir James Pender, Bart., the well-known yachtsman, who captured Mid-Northamptonshire from the Liberals in 1895, defeating the Hon. Robert Spencer. The new member contested South St. Pancras as a Municipal Reformer in the L.C.C. elections of 1910 and 1913, winning the seat on each occasion by majorities of over 1,000.

Photo by] *[J. Jarman.*

MR. J. C. DENISON-PENDER, M.P.

To both of these gentlemen we wish a long and successful career in the new and larger sphere of life upon which they have now entered.

F

THE SPERRY GYRO COMPASS.

As our knowledge of electrical science advances, each fundamental step forward constitutes the basis for many useful inventions which can be built upon it. The possibilities of utilising the reaction of rotating bodies have been known to mankind for years, but it is only within comparatively recent time that we have had any means for maintaining a high speed of rotation while at the same time eliminating brushes and moving wires, which might disturb the equilibrium of the wheel. This fundamental step was made by the development of the induction motor, and as a result of this step we now have the gyro compass, or, we may say, the electrical compass, inasmuch as its operation depends entirely upon the application of electricity.

The development of the gyro compass has come at a very opportune time. The use of steel in our modern ships has made the ship a magnetic shell, so that very little magnetism reaches the magnetic compass, and it is consequently weak and vacillating in its tendency to hold the north, and its use involves the constant application of numerous corrections, many of which are very imperfectly known.

On the other hand, the gyro compass depends for its directive force upon an earthly phenomenon which is absolutely changeless and undeviating. This phenomenon is the rotation of the earth. The manner in which this phenomenon might be used to keep the gyro compass in the north and south meridian has been known for years, but the problem has been so difficult that few have attempted it, and hardly any have been rewarded with anything like success.

A brief description of the theory of the gyro compass will give the reader an understanding of the problem involved in its development, and will enable him to understand how this problem has been solved in the Sperry gyro compass.

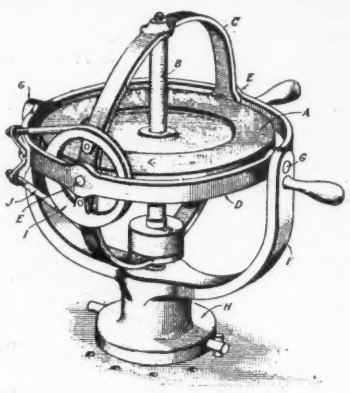


Fig. 3.—Model Gyroscope.

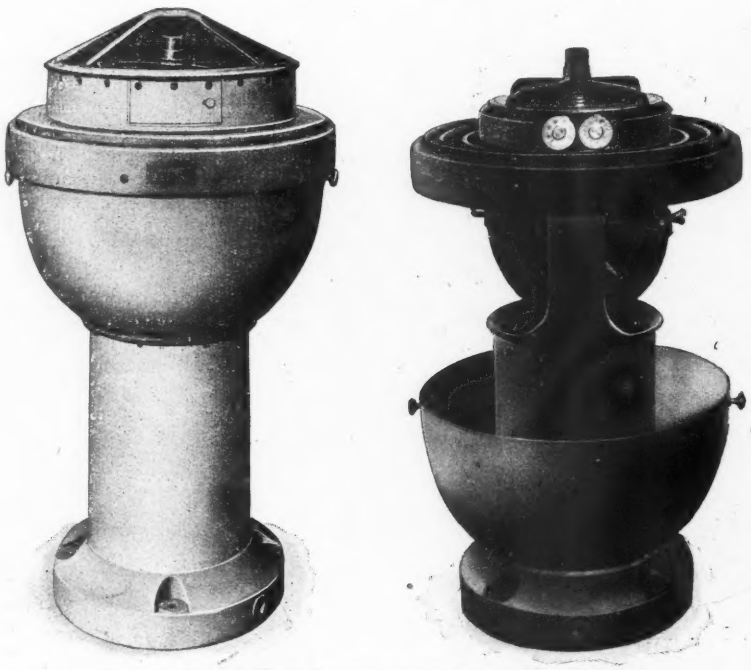


Fig. 1.—Sperry Gyro Compass, with and without Cover.

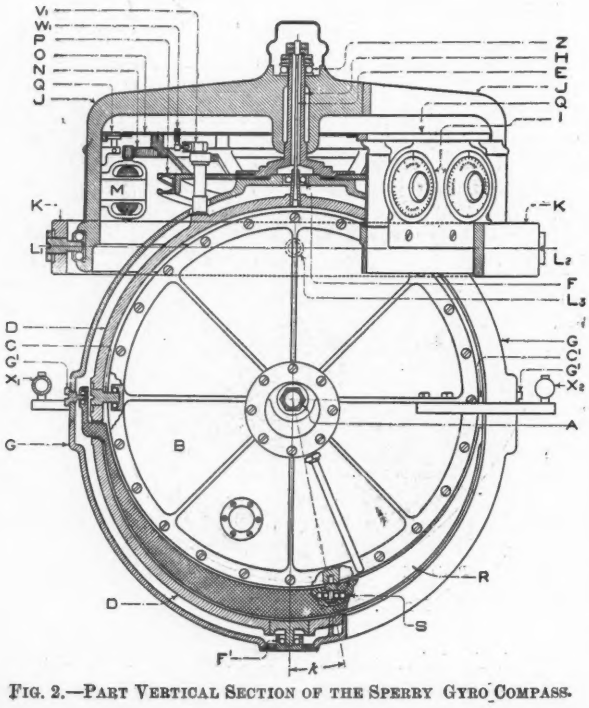


Fig. 2.—Part Vertical Section of the Sperry Gyro Compass.

The inertia of a rotating wheel is relative to space, and by reason of its rotation it offers great resistance to any angular movement impressed upon it. Impressing any angular force on a rotating wheel tending to deflect its plane of rotation results in an angular movement at right angles to the impressed force, termed precession.

For instance, we have in fig. 3 a gyroscope suspended so that it is free to rotate about its vertical axis B B, and free to move about the horizontal axes E E and G G. If we impress a force about the axis G G by pushing down on the near side of the horizontal ring, that force will be resisted, and movement of the gyro will take place about the axis E E, the top of the ring C moving to the left.

If we had impressed the force about the axis E E by pushing to the left on the top of ring C, movement about the axis G G would have taken place. In other words, the gyroscope tries to place itself so that it is rotating in the plane of the force impressed upon it.

If we had maintained the impressed force on the near end of the axis E E, the rotating wheel would eventually have turned to rotate in the plane of the force we had impressed upon it, which in this case would be the vertical plane.

Inasmuch as the inertia of the gyro is relative to space, if the wheel is rotating in a vertical plane with the axis east and west, and if the wheel is suspended with freedom about all axes, the earth in turning will tend to rotate "out from under" it, and the axis of the gyro will apparently incline relatively to the horizontal at the particular spot where it is situated. If we use gravity or some other means to suppress the freedom of the gyro, so that it inclines against an impressed force, precession towards the meridian will be instituted. This precession will continue until the axis of the gyro precesses across the meridian and the earth turns "out from under" it in the opposite sense, thus causing it to precess back. If freedom is further suppressed about the vertical axis, the gyro will not only precess towards the meridian when its axis is inclined, but will also precess towards the horizontal, so that the oscillations will be damped,

and the compass will, within a comparatively short time, settle down into the only position of equilibrium it can find, which will be with its axis on the north and south meridian, and with its plane of rotation coincident with that of the earth. This, briefly, is the principle of the gyro compass.

The directive force of the gyro compass depends upon the angular velocity of the earth and upon the speed and weight

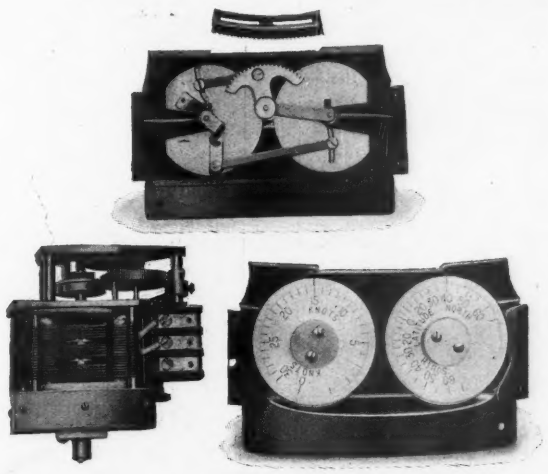


Fig. 4.—Correction Device.

of the wheel. Because the angular velocity of the earth is so very small (one revolution in 24 hours) the directive force of the gyro compass must be very minute, and the problem of the development of the gyro compass becomes extremely difficult. We find, however, that the directive force varies directly as the speed, but as the square of the weight, so from this we see that to get an efficient gyro compass we must use a heavy wheel, inasmuch as a large increase in speed will not give very much of an increase in directive force, and will have mechanical disadvantages which are always inseparable from high speeds of rotation. No matter if a very heavy wheel is used, the directive force will still be very small, so we must find some means of suspending this wheel which will almost entirely eliminate friction about the vertical axis.

A further problem is involved due to the fact that the freedom of the wheel must be suppressed about the horizontal and vertical axes by just the right amount for the purpose in hand. After these things have been accomplished, we find that the gyro compass has a certain natural error depending upon three variables, viz., the speed and course of the ship in which it is mounted and the latitude. If we depend upon tables to correct these errors, we have not made much of an advance from the magnetic compass, inasmuch as the application of corrections from tables is always a confusing process and a serious disadvantage.

The instrument must also be made substantial and durable, as it is quite likely to receive considerable knocking about on board ship.

To summarise, the problems involved in the development of the gyro compass are :—

1. To provide a method of suspension which will permit of the use of a heavy wheel, while at the same time providing perfect freedom for the wheel to move about the vertical axis.

2. To provide a means for suppressing the freedom of the wheel about the horizontal and vertical axes by just the right amount to cause it to settle down on the meridian.

3. The force used for suppressing forces about the horizontal and vertical axes must necessarily be some form of pendulum or device acted upon by gravity, and must be such that the acceleration pressures arising from roll, pitch and change of speed of the ship do not cause deviations of the compass.

4. To correct the natural error of the compass automatically, so that no tables are necessary.

5. To make the instrument substantial and durable.

The manner in which all of these problems are solved will be readily understood by reference to fig. 2, which is an elementary partial vertical section of the compass through its east and west plane. The wheel is here considered as rotating on the axis A, which is perpendicular to the plane of the paper. The axis A is carried on bearings in the air-tight casing B ; this casing is further suspended on horizontal pivots in the vertical ring D.

The gyro wheel, its casing and the vertical ring D are termed the sensitive element in contradistinction to the non-sensitive frame. The ring D is suspended by a stranded steel wire E, the top of which is carried in the stem H. This stem forms a part of the frame surrounding the sensitive element and carrying the compass card. Part of this frame is termed the "phantom" ring (marked G in fig. 2).

Fastened to the ring D and projecting through, but not touching the ring G, is a small post, on which is carried a silver trolley wheel V_1. This trolley wheel rests on contacts W_1, which are carried on the frame surrounding the sensitive element. The silver trolley wheel co-operating with these contacts controls the motor M. The shaft of this motor carries a pinion which drives the frame surrounding the sensitive element.

It can be seen that the stranded wire suspension permits the use of a very heavy wheel. As the wheel tends to turn about the vertical axis in its tendency to place and keep itself in the north and south meridian, the silver trolley wheel co-operating with the contacts W_1 operates the motor M to cause the stem, frame, and phantom ring to follow the gyroscopic or sensitive element. It can be seen from this that friction about the vertical axis is almost entirely eliminated, inasmuch as the top of the suspension wire is constantly made to move to follow the bottom of it, so that it is virtually a torsionless wire. The gyroscopic or sensitive element need only manifest a tendency to move, all the work of movement being assumed by the motor M.

The phantom ring G is always held in positive relation to the ring D, but is nevertheless quite independent from it, and consequently can be used as a base from which to suppress the freedom of the gyro wheel. The freedom is suppressed by the pendulum R, swung in horizontal pivots in the ring G, and attached to the gyro casing at the point S. When the axis of the gyro is perfectly horizontal the pendulum R has no effect, but if the axis of the gyro is off the meridian, the earth will cause it to incline against the weight

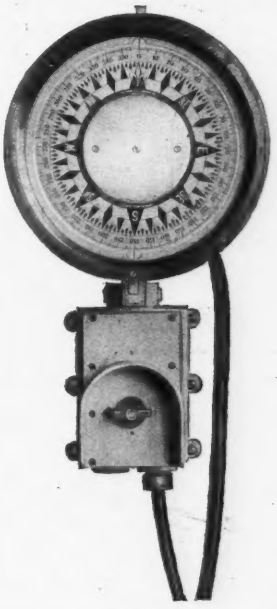


Fig. 5.

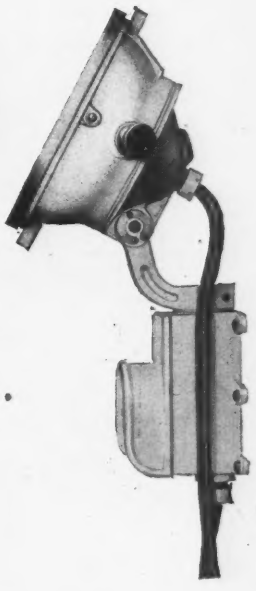


Fig. 6.

Repeater Compass.

of the restraining pendulum, which will impress a force about the horizontal axis and also about the vertical axis, inasmuch as the point S is eccentric to the vertical axis of the gyro. The effect about the horizontal axis institutes precession towards the meridian, while the effect about the vertical axis precesses the axis of the gyro back to the horizontal position, and so damps the oscillation of the gyro to

cause it to settle down in its only position of equilibrium, which is with the axis north and south and horizontally.

To correct automatically the natural errors of the compass, an arrangement of cams is used. These cams are laid out on curves of the logarithmic functions of the variables. The dials of the cams for speed and latitude can be seen in fig. 2 These are set to approximate speed and latitude by hand ; the cam for course is under the compass card, and is set by the compass itself. These cams serve to adjust constantly and automatically a system of levers, which are so arranged as to add or subtract their arms and adjust the reference point or lubbers' line of the compass to correct its natural error. Front and back views of this correction device are shown in fig. 4.

It can be seen from fig. 2 that the instrument has few parts, and is consequently very substantial and durable, and not at all likely to get out of order.

Attached to the gyro casing are the levels x_1 and x_2. If

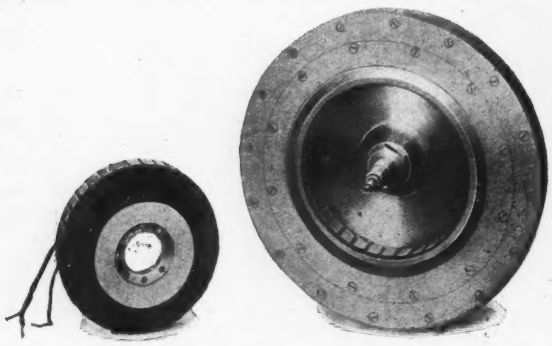
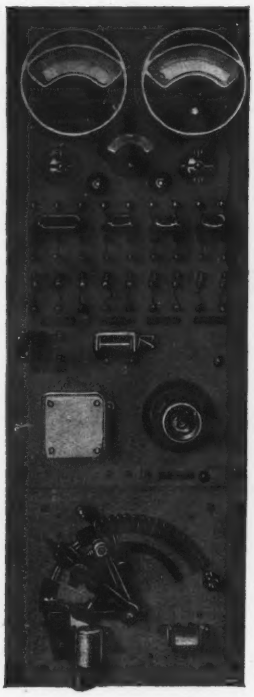


Fig. 7.—Gyro Wheel and Stator.

position in the ship, and is used to operate repeater or auxiliary compasses utilised for steering and navigating the



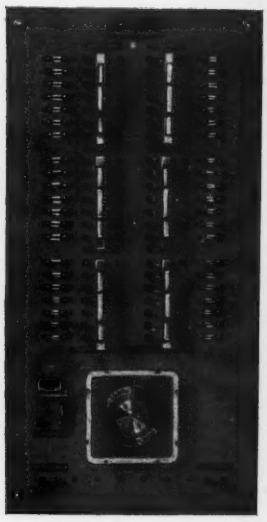


Fig. 8. Fig. 9.

Main and Synchronising Switchboards.

the axis of the gyro should for any reason be displaced from the meridian, it must necessarily incline, and this inclination will be shown by the levels. Consequently a glance at the levels will always reassure one as to whether the compass is exactly on the meridian or not. In fact, if one should deliberately try to force it off the meridian, the

ship. These repeater or auxiliary compasses are operated by a rotary step-by-step system, which in principle is similar to that used in electric clocks and other devices for reproducing movement at a distance.

Figs. 5 and 6 are illustrations of one type of repeater compass. The small switch shown is used for varying the

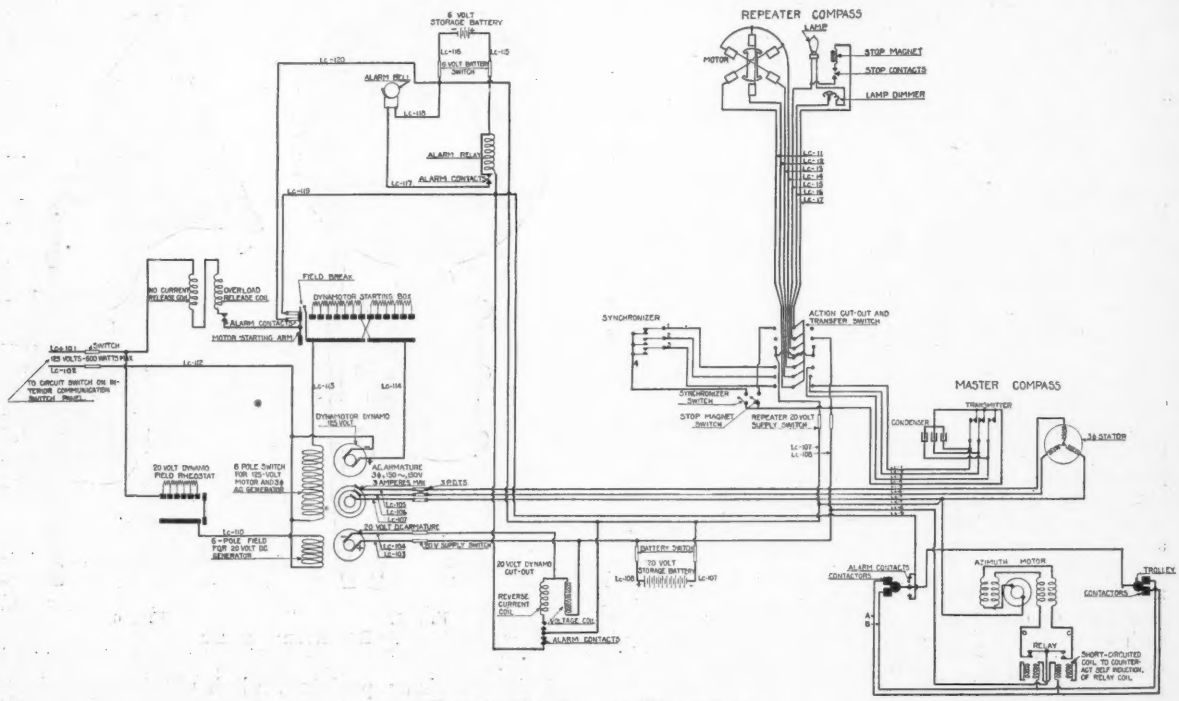


Fig. 10.—Diagram of Connections.

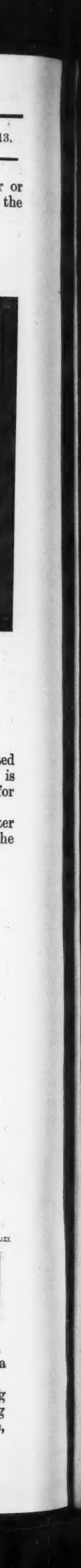
levels would show that it was going off before any deviation took place.

Fig. 1, p. 942, shows the appearance of the master compass with covers removed, and with covers in place.

The master compass is placed in a well protected

amount of illumination on the card, which is obtained by a small lamp placed behind it.

Another type of repeater compass is used for taking bearings. The repeater compass for this purpose is swung in gimbal rings, and is used in conjunction with an alidade,



or azimuth circle, with which the true bearing of any object can be obtained directly.

The development of the gyroscopic compass has involved numerous electrical problems of the greatest interest.

The gyro wheel is spun by an induction motor at a normal speed of about 8,600 R.P.M., although the directive force is quite sufficient when the speed is anywhere about 3,000 R.P.M. The wheel is shown in fig. 7, and, as can be seen from this view, the inside of the wheel is hollowed out, and the internal periphery is inlaid with the short-circuited bars of the induction motor. Attached to the side of the wheel casing, and projecting inside the wheel, is the stator, which is shown to the left in fig. 7.

To reduce the amount of power used, the wheel is spun in a vacuum, and for this reason the major problem in the design of the induction motor was to arrange the windings and laminations, so that the heat arising from the current would be efficiently conducted to the outer fins of the casing and radiated from them. A surprising degree of success has been attained in this, which makes it possible to keep the wheel quite cool, although there is no air wash to facilitate the removal of heat.

The design of the contacts for controlling the azimuth motor was a very interesting problem, as they are constantly making and breaking contact, and must be so designed that this constant make and break will not "pit" them.

After a great many trials of all sorts of contact material it was decided to use tungsten. The efficiency of a contact which is constantly making and breaking depends upon the melting point of the material used. The melting point of tungsten is far above that of any conductor except carbon, and carbon is prohibitive for contacts on account of its high resistance when used for that purpose. As a solid block of tungsten cannot be obtained, it was necessary to use a sheet of tungsten "wetted" to a steel back by means of copper. The tungsten could not be wetted directly to the steel back, as the oxide between tungsten and steel is a non-conductor. The oxides between tungsten and copper and between copper and steel are conductors. Wherever used on the compass the contacts are made quickly detachable, so that they may be conveniently withdrawn and examined.

The silver trolley co-operating with the tungsten contacts controls the azimuth motor M_2 by means of a relay, so that the current broken by the contacts is very small. Still further to reduce the spark at these contacts the relay coils are wound with a secondary winding of exactly the same size as that used for operating the relay. This secondary winding is short-circuited. The current generated in the secondary relay coil upon making and breaking exactly counteracts the induction of the active coil, and so absolutely eliminates any spark discharge at the contacts.

The azimuth motor is wound with two separate sets of field windings, wound in opposite directions. This makes it possible to reverse the motor with one contact. It also makes it possible to reverse the motor almost instantaneously, inasmuch as the current does not have to die down and build up in the same set of fields.

The commutator of the azimuth motor is novel, in that the insulation between the commutator segments is not extended to the surface of the segments. This gives absolute reliability in the azimuth motor, as there is no possibility of the insulation holding the brush off the commutator.

The transmitter for operating the repeater or auxiliary compasses has three pairs of tungsten contacts, operated by steel cams driven by the master compass.

Three-phase alternating current, at a voltage of about 100 and a frequency of about 150 cycles, is required for spinning the gyro wheel. The relay, azimuth motor and repeater compasses are operated by means of 20-volt direct current. The ships on which the compass is used usually have a supply of direct current at a voltage of 125 or 220, and this current is converted into alternating current and 20-volt direct current by means of a so-called dynamotor-dynamo. This dynamotor-dynamo has two sets of fields both energised from the current of the ship. Rotating within one of these fields is an armature, on which are wound the direct-current motor windings, and in the same slots the three-phase alternating-current windings. Rotating within the other set of fields is an armature wound to produce 20-24 volt direct current.

A 10-cell accumulator is floated on the 20-volt line. An automatic cut-out between the 20-volt generator and the battery automatically cuts out the generator if its voltage falls below that of the battery and automatically cuts it in again immediately the voltage rises above that of the battery. This cut-out has two coils wound on the same core, one in series with the current and one in shunt, the design being similar to that of devices used on automobiles.

Fig. 10 is an elementary diagram of the electrical system. The synchroniser connections there shown are for the purpose of adjusting the repeater compasses to synchronise them with the master compass when first starting. When synchronising, the repeater compasses are connected to the synchroniser, which is a hand-operated transmitter, and a circuit to a stop magnet within the repeater is connected. The synchroniser is then turned, so that its card passes through 360°. No matter where the repeaters have been previously, the synchroniser must turn them to the zero point. When they are near the zero point, contacts on the repeater card complete the circuit to the stop magnet, which draws a latch down on the armature shaft of the repeater motor. When the repeater comes to exact zero this latch falls into a slot on the armature shaft, and thus stops and locks the repeaters at zero.

The operator in the central station thus knows that after he has turned the synchroniser through 360° the repeaters must all be at zero. He then turns the synchroniser to zero, and releases the stop magnet. The repeaters must now be at the same reading as the synchroniser, and free to turn with it. As the synchroniser or repeater switchboard is immediately adjacent to the master compass, the operator has only to glance at the card of the master compass to see what the reading of the repeaters should be; he then turns them to the reading of the master compass, and switches them off the synchroniser and on to the compass.

An alarm system is provided which immediately gives notice of failure of the supply of current to the dynamotor-dynamo, or of failure of the 20-volt direct current. Contacts on the master compass also serve to operate this alarm, in case the frame of the master compass fails to follow.

After much study and experiment a very convenient switchboard has been evolved for the supply of current to the gyro compass system. The most convenient feature of this switchboard is the small direct-current voltmeter and voltmeter switch, which are used for finding the voltage of the supply, the voltage of the battery, the voltage at the 20-volt dynamo terminals, and positive or negative leakage in any part of the circuit. The connections to this voltmeter which make it possible to find the leakage at any time are especially valuable, as it will usually be found that the only source of trouble on board ship with electrical apparatus is leakage in the wiring of the ship between the various parts of the apparatus. Leakages are usually due to nothing but neglect, and if convenient means are provided for ascertaining whether or not there is leakage at any time, it is a very simple matter to hunt down and eliminate the trouble.

Fig. 8 is a view of the main switchboard, and fig. 9 shows the switchboard used for cutting out and synchronising the repeater compasses.

Space does not permit of our dwelling on the many advantages which accrue to men-of-war, submarines and merchant ships by the use of an absolutely accurate compass without "lag." Most of these advantages, however, are quite obvious. It may be interesting to add that repeated tests of the Sperry gyro compass under the most severe conditions of roll, pitch and change of speed, have failed to show a deviation of more than $\frac{1}{4}$ of a degree at any time.

A branch office of the Sperry Gyroscope Co. has been opened at 57, Victoria Street, London, S.W., and in this office will be installed a gyro compass mounted on a testing machine capable of subjecting the compass to heavy roll and pitch and rapid changes of course.

The Sperry gyro compass is now in successful operation on board some 16 battleships of the United States Navy, in addition to eight submarines. Wherever it is used the compass is depended upon for all purposes connected with navigation, to the exclusion of the magnetic compass, which is used as an occasional check; and up to the present time its adoption has proceeded without encountering that manifestation of the laws of inertia known as "conservatism."

NOTES.

(*Concluded from page* 940.)

"The Point Fives."—We are informed that Dr. Ferranti will open the discussion at the meeting on June 17th, which will take place at the Delico Restaurant at 7 o'clock (tickets, 3s. 6d.).

At the recent debate on the standardisation of cookers, the following "five points" were unanimously agreed upon:—

"Whilst "The Point Fives" in no way wish to hamper the development of cooking apparatus by attempting, at this early stage, to standardise details, they desire to place before manufacturers a number of general preliminary principles which, as a result of their use of various types of cooking apparatus, they consider to be of importance:—

"(*a*) That domestic and other cooking ranges (consisting of oven, grill and hot plates) should have each sub-circuit separately fused, and each protected by a switch. (The oven should have two or more circuits.)

"(*b*) That switches and fuses be placed in such a position that they cannot become unduly heated, that they cannot be damaged by liquids being spilt over them, and that they are easily accessible.

"(*c*) That provision should be made for efficiently and thoroughly earthing all apparatus.

"(*d*) That cooking ranges be fitted with at least one indicating device (separately fused), which will clearly show whether any circuit is turned on.

"(*e*) That manufacturers and designers should endeavour to develop a hot plate which will work satisfactorily at a red heat."

In the time available it was found impossible to deal fully with this matter, and it was left for future meetings to add to the above-mentioned points. The standardisation of electric tariffs was also deferred to a future meeting.

Electric Vehicle Progress in England.—Supporters of the movement to introduce the electric battery vehicle into this country on a practical scale will welcome the news that an unofficial reliability run is to be made next week from Dumfries to London, by an Arrol Johnson-Edison coupé, a product of the Arrol Johnson Co., which, as previously mentioned, has taken up the manufacture of electrical vehicles, and judging by external appearance, has succeeded in producing a handsome equipage.

The body, of aluminium, is mounted on an underslung chassis with Lanchester type springing. The electric motor is in the centre with an "under" worm drive, which is somewhat of a novelty for this type of car, and an Edison battery is placed half under the bonnet and half under the rear seat.

The vehicle is a three-seater with wheel steering, the wheel being inside, as in the majority of American electrics.

The Dumfries-London run is, of course, partly intended for demonstration purposes, and the various halts are more numerous than would otherwise be the case. These include (Monday) Carlisle, Penrith, Kendal, Lancaster, Preston and Manchester, where the night will be spent. From Manchester (Tuesday) the run will be *via* Burslem, Stafford, Walsall, Birmingham, Rugby, Northampton, Bedford, Luton and Barnet, at each of which a short stop will be made, the arrival in London being timed for about 11 p.m.

The organisation of the trip is due to Mr. W. H. L. Watson, of the Edison Battery Co., who has invoked the aid of the numerous central station engineers in the towns visited. We understand from Mr. Watson that in connection with the paper on electric vehicles to be read at the Kingston meeting of the I.M.E.A. on June 19th next, 16 different electrics, of both the pleasure and commercial types, by various makers, will be on view for demonstration purposes, thus affording an excellent opportunity for close acquaintance with the modern battery car, the successful introduction of which depends so largely on the charging facilities which the municipal authorities must now be prepared to give.

It is a sign of the times that H.M. Post Office has now obtained a trial electric mail truck, built by the Silvertown Co., for postal deliveries; we understand that a wholesale adoption of these trucks, in place of horse vans, in one centre, is being considered, the Postal authorities possessing exceptional facilities for battery charging from their own plants. In London, Messrs. Liberty's have obtained the first of 30 Edison battery cars for town delivery work; Messrs. Harrods have received four 1-ton Edison battery vans, and are proposing to introduce 60 for London deliveries, while we gather from Mr. Watson that his firm has inquiries for as many more. It is interesting to notice that the Glasgow Corporation is proposing to obtain 25 battery-driven scavenging vehicles, and the Marylebone Council is considering the adoption of 18 similar vehicles.

The Ilford authorities have an Edison battery 'bus under consideration, and a tower wagon for tramway repair work, equipped with an Edison battery, has been adopted by one system.

From the foregoing it will be gathered that station engineers must now seriously consider the matter of providing adequate charging facilities. The standardisation of the charging voltage is also a matter of the first importance.

The I.E.E. Conversazione.—Invitations have been issued by Mr. W. Duddell, F.R.S., President, and Mrs. John Smithers, and the Council of the Institution of Electrical Engineers to the conversazione to be held at the Natural History Museum, Cromwell Road, S.W., on Thursday evening, June 26th, from 9 to 11.30 p.m.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The town electrical engineer and tramways manager of East London, South Africa, MR. J. MORDY LAMBE, expects to arrive in this country in June. In view of the considerable extensions in the electricity supply and tramways undertakings of East London now in contemplation, Mr. Lambe is particularly interested in central station plant and machinery and motor-'buses, and will attend the Imperial Motor Transport Conference to be held in England in July. His address will be:—Care of Wm. Dunn & Co., Broad Street Avenue, London, E.C.

Owing to the operation of the Glasgow Boundaries Act, 1912, MR. T. C. PARSONS and MR. W. SILLERY have retired from the management of the Govan and Partick electricity undertakings respectively.

At the Watford Council Offices recently, the staff presented to MR. F. W. PURSE, the electrical engineer, who has been appointed to a similar post at Carlisle, a silver coffee-pot and four silver vases. The presentation was made by Mr. W. F. Goodrich, chairman of the Council.

Accrington Electricity Committee has engaged MR. HARVEY WHITTLE as a special canvasser for the department.

Having concluded 12 years' service at Weybridge with the Urban Electric Supply Co. as assistant engineer, MR. SELBY HOWARD, has been presented with a silver cigarette case and a cheque by the employés. Captain H. W. Watts, resident engineer, made the presentation on Thursday last week, at the Lincoln Hotel.

MR. ARNOLD GILL has been appointed second assistant electrical engineer at the electricity works of the Hebden Bridge District Council.

We understand that our notice of last week with reference to Basingstoke electric lighting was not quite correct. Mr. John B. Morgan, electrical engineer to Horsham U.D.C., only asked the permission of his Council to render assistance to Mr. F. R. Phipps, the Basingstoke surveyor, in connection with the preliminary preparations for the electric lighting scheme which has been placed in his hands. The work of supervising and laying down the plant will be undertaken by the Basingstoke officials.

The salary of MR. J. SHEPPARD, mains engineer of the Southampton undertaking, has been advanced from £104 to £130 per annum.

MR. A. G. LOW has resigned his position with the Carlisle Corporation to take up the post of shift engineer at the Stockton-on-Tees Corporation Electricity Works.

Tramway Officials.—The Tramways Committee of the Derby T.C. has increased the salary of MR. P. W. BANCROFT, chief clerk, from £130 to £156 per annum.

The Blackpool Tramways Committtee has increased the salary of MR. F. S. FIELD, tramway engineer, from £3 10s. to £4 per week.

At the West Ham Tramways Committee meeting on Tuesday last, the resignation of MR. H. E. BLAIN from the position of manager was received and considered. Mr. Blain is about to take up an appointment elsewhere in this country. The Committee decided to recommend the Council to accept the resignation with regret, and many good things were said regarding the splendid service rendered to the borough by Mr. Blain. It is proposed that the Council present him with an illuminated testimonial under seal, and that a successor be advertised for at a salary of £550 per annum, advancing by £50 per annum up to £700.

General.—MR. LAWFORD GRANT has resigned his position as president and managing director of the Canadian British Insulated Co., Ltd., Montreal, to take over the managership of the Eugene F. Phillips Electrical Works, Ltd., Montreal, one of the largest wire and cable factories in the Dominion of Canada. Mr. Grant, who is the honorary secretary-treasurer for Canada of the Institution of Electrical Engineers, has built up a large business for the Canadian British Insulated Co. He went from England to Canada about six years ago as manager of the company in the Dominion, and later assumed the position of president and managing director of the Canadian Co., which, we understand, now numbers amongst its customers all the most important power supply companies and cities in Canada.

MR. FRANCIS W. T. BRAIN, Gloucestershire's new knight, has been closely identified all his life with the mining industry of the Forest of Dean. We are informed that he was a pioneer in the application of electricity to mining. Our correspondent writes:—"It was at the Trafalgar Collieries, with which he is still associated as managing director, that electricity was first applied underground. This was in January, 1883. He contributed papers explanatory of the work done, to the South Wales Institute of Mining Engineers, and also to the Bath Meeting of the British Association in 1886. Mr. Brain is recognised as an expert in electric blasting. Electric fuses, now so generally used in collieries, were first perfected and supplied by him more than 25 years ago, and the Cinderford or Brain's fuse, manufactured under his patents, is still well known and largely used. He was President of the Mining Association of Great Britain in 1911-12."

On the occasion of the visit of MR. JOHN BURNS to Beckenham last Saturday to open Kelsey Park to the public, he was welcomed by Mr. George Sutton, J.P., in his capacity as chairman of the District Council. A commemorative oak tree was planted by Mrs. Sutton.

MR. W. J. LING has resigned his position in the electrical department of Messrs. A. Emanuel & Sons, Manchester, and has joined Mr. A. Borghys (trading as Royer & Borghys, 59 and 61, New Oxford Street, London, W.C.) as a partner. The name of the firm will be unaltered.

ALD. H. W. PEAL, J.P., chairman of the Borough of Ealing Electricity Committee, is lying ill at Switzerland with rheumatic fever. Though reported to be making satisfactory progress, it will be a considerable time before he is able to return home.

The *Australian Mining Standard* states that MR. W. M. ARNOT has resigned his position as general manager of Messrs. Siemens Bros., and intends visiting London on private business at an early date.

Obituary.—Our readers will regret to hear that CAPT. W. R. LUGAR, who had been in bad health for six months, passed away at his residence, 5, South Street, Halifax, N.S., at 4.30 a.m. on May 21st, in his fifty-ninth year. The Nova Scotia papers pay tribute to his memory and to the esteem in which he was held by all, and his English friends will be in accord with the expressions of the *Halifax Recorder*, which says: "Captain Lugar was highly esteemed for his many sterling qualities. Conscientious in all his dealings, he has passed away to the deep regret of those with whom he was brought in contact." We extend to Mrs. Lugar and the sons and daughters our deep sympathy in their bereavement.

We regret to read of the death, which occurred on May 30th, at Catford, of MR. FREDERICK HENRY ALMROTH STEVENS, who was for 48 years with the Telegraph Construction and Maintenance Co., in his sixty-third year. The funeral took place on Tuesday last at Hither Green Cemetery.

Will.—MR. E. M. UNDERDOWN, K.C., chairman of the Direct U.S. Cables Co., Ltd,, who died in April, left £108,556 gross and net personalty £14,057.

CITY NOTES.

Crompton & Co., Ltd.

AN extraordinary general meeting of this company was held on Wednesday at Salisbury House, E.C., to consider a scheme for reconstruction, and to pass resolutions adopting same and winding up voluntarily (with Mr. E. Reeves as liquidator) for the purpose of registering a new company, to be named Crompton & Co., Ltd. A second extraordinary general meeting is to follow on June 19th for confirmatory purposes. The letter issued to the shareholders contains the following statement explaining the reasons of the board for bringing forward the scheme at the present time:—

"For some time past the directors have had under their careful consideration the question of the reorganisation of the company's capital, and the provision of further working capital which is urgently required to enable the business to be carried on at a profit to the shareholders. The demand for electrical machinery and appliances is increasing and prices are rising; consequently the present appears to be a favourable opportunity for placing the company in a position to take advantage of the improved trade conditions. During the ten years ending March 31st, 1909, the profits earned by the company, after providing and paying all outgoings, including depreciation, interest on debentures and loans, &c., amounted to £143,324, or an average of £14,332 per annum. In the years ending March 31st, 1910 and 1911, and in the first half of the following year, there was a scarcity of orders, and losses were incurred, due partly to inability to keep the works profitably employed and partly to losses on a contract abroad. Since 1911 the position has much improved. The volume of orders has increased, considerable reductions have been made in the standing establishment charges, and, with adequate working capital, it is fully anticipated that satisfactory profits will be earned. With a view to the adjustment of the capital account, and to the introducing into the business of the necessary working capital, the directors, after consultation with the principal shareholders, have decided to recommend the scheme of reconstruction, which is fully described in the memorandum enclosed herewith, and which can be carried through with but little, if any, interference of the company's business. The directors are of opinion that with this fresh capital the prospects of the new company will be distinctly favourable. The amount required to pay 7 per cent. dividend on the proposed preference shares is £9,520, and arrangements have been made to underwrite the issue."

The scheme of reconstruction submitted by the directors includes voluntary liquidation with a view to the transfer of its undertaking to a new company in consideration of (*a*) The discharge by the company of the debentures of the present company and the performance and fulfilment of the pending engagements of the present company, and the costs and expenses of and incidental to the liquidation of the present company. (*b*) The allotment and issue to members of the present company of fully-paid ordinary shares provided for below. (*c*) The rights of the shareholders of the present company to apply for and have allotted to them, and/or their nominees, partly-paid shares in the new company on the terms stated below.

The new company will be incorporated with a capital of £221,000, divided into 221,000 shares of £1 each, of which 136,000 shall be 7 per cent. non-cumulative participating preference shares of £1 each, and 85,000 ordinary shares of £1 each for the purpose, *inter alia*, of carrying on the business of the present company. The preference shares will be preferential both as to dividends and capital, and will also be entitled, after payment of a non-cumulative dividend on the ordinary shares of the company for the time being at the rate of 7 per cent. per annum, to participate in the profits available for further dividends, *pari passu*, with such ordinary shares, and after repayment of the capital in a winding-up to participate in the surplus assets, *pari passu* with such ordinary shares in both cases in proportion to the amounts paid or credited as paid on the preference and ordinary shares respectively. The 85,000 ordinary shares will be allotted, credited as fully-paid up, to the registered holders of the ordinary shares in the present company, and/or their nominees, in the proportion of one ordinary share for every one existing share held by them; the preference shares credited with 12s. 6d. per share paid-up, to be offered to the registered holders of shares in the present company, and/or their nominees, in the proportion of eight of such preference shares for each five shares held by such shareholder in the present company. Failing acceptance of any of the preference shares by the shareholders of the company, and/or their nominees, within the period specified below, such shares shall be issued to the nominees of the liquidator of the present company, credited with 12s. 6d. per share paid thereon.

The new company shall be at liberty to issue first debentures for £100,000, carrying interest at the rate of 5 per cent. per annum, for the purpose of being exchanged for the debentures of the present company, such new debentures to constitute a first specific charge on the freehold and leasehold property, patents and patent rights of the present company, and a first floating charge on the remainder of the property, present and future, of the new company, including its uncalled capital, and to be secured by a trust deed in a form to be approved by the trustees of the trust deed securing the debentures of the present company.

The period during which the holder of shares in the present company shall be entitled to claim as of right by himself and, or his nominees, an allotment of preference and ordinary shares in the new company, is to be stated in the notice, or notices, inviting applications for such shares, but shall not be less than seven days from the posting of such notices.

The unpaid liability of 7s. 6d. per share on the preference shares of the new company shall be payable as to 1s. per share on application, 1s. 6d. on allotment, and the balance by calls not exceeding 2s. 6d. per share at intervals of not less than three months.

The new company shall be at liberty to procure the underwriting of the whole of the preference shares at a commission of 5 per cent. and an over-riding commission of 1 per cent. on the sum of £51,000 which will be provided by the issue of those shares, and also to pay the expenses of and incidental to the formation of the new company, and of the transfer to it of the property and assets of the old company.

We understand that at the meeting on Wednesday the resolutions were carried without opposition.

British Thomson-Houston Co., Ltd.

THE eighteenth ordinary general meeting was held on Wednesday, May 28th, at the offices, 83, Cannon Street, E.C., Mr. J. F. Nauheim presiding.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV.) said the past year had been a very satisfactory one from the point of view of orders received. Both in the home and export trade they had had record figures, but, on the other hand, their deliveries had not been satisfactory owing to the great difficulties which they experienced in obtaining raw material owing to the coal strike. Those difficulties continued up to the end of the year and seriously affected their output, and it was largely owing to this that the profit for 1912 was only as large as that shown for 1911. They had, however, also to take into consideration that they had had to pay higher wages, the cost of the new Insurance Act and the increased amount for interest on the advances to pay for the various extensions mentioned in the report. Generally speaking, they had made good progress, and the volume of business secured in 1912, which would come into account in 1913, entitled them to look forward to a very favourable result for the present year, all the more so that the orders secured since the beginning of this year showed an important increase over those secured in the same period of 1912. The workshops were fully occupied, and the additional facilities which they had provided justified entirely the large outlay of capital already expended and to be incurred.

MR. G. FRANKLIN seconded the motion, and the report was adopted.

Birmingham District Power and Traction Co, Ltd.

THE meeting of this Company was held on May 28th, at Electrical Federation Offices, Kingsway, W.C., MR. C. S. B. HILTON presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 907), said that at the meeting last year he stated that the business had shown expansion in both branches, and he was happy to be able now to inform them that those hopes had not been disappointed, and that the expansion had been continuous throughout the past year and showed no sign of

abatement. The total result of the year's operations showed a surplus of £55,449 15s. 6d. This compared with £52,841 16s. 0d. in the preceding year. Those results were really better than they appeared. In 1911 they had an exceptionally fine summer, which had a beneficial effect on the general traffic of the tramways, while last year's receipts were prejudicially affected by the exceptionally bad weather, in spite of which, however, the traffic receipts showed an increase of £2,400, and the receipts from parcels an increase of £700, while the expenses of the tramways department showed an increase of only £400, and the receipts of the tramways of the subsidiary companies showed improvements in all cases. Turning to the electricity supply, the Company's steady progress was well maintained. The receipts showed an increase of £3,000, while the expenses had increased by about £2,300. The increase of profit was, though small, satisfactory, as it represented current sold to new consumers, who had more than replaced one very large consumer who was supplied at a very low rate. Repairs and maintenance showed a slight increase, and there was a small increase in administration and general expenses. The renewals account had again been credited with £5,000; £3,000 had been added to the reserve fund, against £3,570 in 1911, while the sinking fund, under the operation of the trust deed, received £460 more. The dividends and interest received on investments from the associated companies amounted to £30,180, compared with £29,861 in the previous year, and this in spite of the fact that the Electrical and Industrial Investment Company paid no dividend on its ordinary shares, in which that company had so large a holding. The renewals account now stood at the substantial sum of £12,000, and the reserve account at about £12,500, while the debenture sinking fund stood at £27,919, making altogether over £52,000 passed to various reserve accounts from profits. In addition to these sums the subsidiary companies had separate reserve and renewals funds, the total amount of which was £68,744. Turning to the capital account, until the Smethwick Electric Lighting undertaking had been transferred to the Shropshire Power Company, expenditure on mains and additional plant must be provided by this company, and such expenditure as had already taken place would, it was hoped, be adjusted during the present year, when the undertaking of Smethwick was transferred to the Shropshire Company under the Board of Trade Transfer Order now awaiting confirmation by Parliament. It would then be possible to reduce the loan from the Shropshire Company, standing at £212,091 in the balance sheet, by at least £166,347, the amount expended up to December 31st last on the Smethwick undertaking, and the balance of the loan would be still further reduced if negotiations now in progress for the acquisition of a transfer to the Shropshire Power Company of the electricity supply undertaking in Dudley were duly completed. An amount of £4,843 had been expended at December 31st on the purchase of motor omnibuses out of a total liability of £21,698, of which at present about £6,000 was undischarged. It was considered preferable that the Company itself should purchase omnibuses and lease them to the motor omnibus company rather than that the Company should further increase its holding in debentures of the motor omnibus company. This method had the advantage of enabling the omnibuses to be operated by the company in districts away from Birmingham, should it ever be necessary, as that company was not restricted in its operations to Birmingham only. It was hoped that by the end of the present month 49 omnibuses would be in operation. To summarise, the combined working balances from the two sections of the undertaking amounted to £35,128, an improvement of £3,400. Sundry receipts were about £650 less, interest and dividends from investments £319 more, with the result that after making all the provisions he had referred to, they were able to recommend a dividend of 3½ per cent., against 3 per cent. for 1911, and to carry forward a rather larger sum. While all these results were satisfactory and encouraging, it was important to remember that the operating costs showed a tendency to increase. The increased cost of coal, due to last year's strike, they must accept as permanent, while the prices of all stores and materials had risen, and, in addition the company had been faced with the necessity of improving the rate of pay of the employees all round. Early in April considerable agitation arose amongst the men employed by the Company and the other companies operating the Black Country tramways, for increased pay and improved conditions, and the main argument put forward was the increased cost of living. The men asked to be put on the same scale of pay, etc., as the men employed by the Birmingham Corporation, but it would be realised that what was possible to a municipal system running in a city like Birmingham was not possible for a company serving a poorer and more widely scattered population. The cost of meeting the men's demands on all the Black Country tramway companies would have meant some £7,500 a year, which was about two-thirds of their gross increase in traffic receipts for the past year before providing for expenses. On May 16th they gave the men an all-round improvement in their pay and other conditions. The men recognised that the board had done all that could reasonably be expected of them, and he was hopeful that things would now resume their normal aspect. The CHAIRMAN proceeded to deal with the exchange of the Company's holding in the old City of Birmingham Co., Ltd., for stocks and shares in the Electrical and Industrial Investment Company, which was sanctioned last year, and said there was every reason to expect that for the present year a substantial dividend would be paid by the Investment Company on its ordinary capital, and a larger return might be anticipated on the investment than was received on the old investment previous to 1911. As to their investment in the Birmingham and Midland Motor Omnibus Company, although that company had not quite recovered from the losses made in previous years, it had made substantial progress, and the outlook was encouraging.

MR. S. R. BLUNDSTONE seconded the motion, which was carried unanimously.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

THE seventh ordinary general meeting was held on May 28th, at Winchester House, E.C., MR. R. W. WALLACE, K.C., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 855), said that last year he told them they were unable to pay any dividend on the ordinary shares, because of the cyclone which had taken place, and which destroyed their cooling towers and a large number of their transmission lines. He estimated that the cost of repairing the damage would be about £3,000, but fortunately it only cost them £2,300. The inconvenience of an accident of this kind, over which, of course, the management had no control, did not only extend to the replacing of the damaged plant, but it also affected the working during the year. The brunt of that loss had fallen upon the present accounts, and they estimated that it amounted to between £2,500 and £3,000. He was glad to say that all their difficulties had been overcome; they had no trouble with their consumers, and except for the delay of a few hours they kept their tramways running. Another matter which had depreciated the profits last year was the change in the working of the water supply company from Perth, which consisted in adding chemicals, probably lime, to their water, in order to get rid of the acidity in the water in the mains running from Perth to Kalgoorlie. When those alterations were made the Company took the very best expert advice that could be obtained, for the effect of using that water with the chemicals in it was that coating took place in certain of the tubes in their boilers which necessitated the use of more fuel, thus adding to the expense of working. He was glad to say that the difficulty had been effectively overcome now. With regard to the business, the power sales were very much larger than usual, but the cost of manufacturing had gone up. Last year he told them they were putting down a new unit of plant. That had now arrived, but they had not yet had the benefits of its working. It was satisfactory to be able to say that the new plant had been entirely paid for out of the internal resources of the Company, and they expected that there would be increased profits in the future as a result of further economy in working. In conclusion, the CHAIRMAN said he wished they had been able to declare a dividend on the ordinary shares, but they were not justified in doing so at the present moment, and it was only by the working of the new plant that they could anticipate that their profits would increase to enable them to pay a dividend in the future.

MR. EDWARD POPE seconded the motion.

The CHAIRMAN, replying to Mr. Crosse, said that as the Company was not paying, it was only natural that the shareholders might think that the directors were too highly paid, but he could assure them that the work of the board was no sinecure, and that they were by no means excessively paid. Speaking on the spur of the moment, he should say that the effect of the new plant ought to mean an increased profit of between £6,000 and £7,000, and if that was so, it would enable them to pay a dividend on the ordinary shares.

The report was adopted.

Urban Electric Supply Co., Ltd.

THE annual meeting was held on Wednesday, last week, at Salisbury House, E.C., MR. P. D. TUCKETT presiding.

In moving the adoption of the report (see ELEC. REV., page 862), the CHAIRMAN said that the first and most important item in the accounts was that of profits earned at the various works, and this, he was glad to say, showed a 13 per cent. increase of £6,586, in spite of the coal strike last Spring, which, apart from the indirect loss it entailed, had directly resulted in an extra coal bill of £4,427, compared to what it would have been at the old prices. This represented an increase of 24 per cent. in the price of coal, and he need not tell them that it had proved a heavy burden. It was all the more fortunate, therefore, that trade had been good and that they were blessed with a summer which, in spite of its compensations, he imagined few of them wished to see repeated. But for these favourable influences he was afraid the results for the past year might have proved disappointing, whereas he thought they would agree that the actual results realised were not unsatisfactory. The balance of £54,265 carried down to net profit and loss account compared with £47,649 a year ago. Interest charges were up some £3,560 in consequence of the comparatively heavy capital expenditure of the last two years, and the provision for the redemption of debenture stock was increased by £411, leaving a net disposable balance of £18,083. This they proposed to apply by appropriating £10,000 to reserve for depreciation, and £7,500 to the payment of a 3 per cent. dividend on the preference shares, carrying forward £996. Capital expenditure had increased by £54,079, as against £68,606 the previous year, the issued debenture stock, less amount redeemed, being increased from £320,818 to £367,534. The principal change, however, arose out of last year's reduction of capital. The ordinary share capital now stood at £240,000, instead of at £400,000 as

formerly, the difference of £160,000 being represented by the new capital reserve fund, against which had been written off the expenses incurred in connection with the reduction of capital and the cost of plant dismantled, hitherto appearing as a suspense account item on the assets side. The existence of a fund formed in this way, and representing their estimate of the depreciation or permanent loss of capital value existing at the date of the capital reduction, was, of course, unusual, but they felt that in the case of a company whose undertakings were subject to purchase, it was desirable to deal with the matter in this way, writing off losses from time to time as they were actually ascertained, rather than to reduce their assets by the full amount at one stroke. The existence of this fund in no way relieved them of the obligation to provide for current and future depreciation. It was essentially a fund to provide for a potential loss which already existed, but of which only a small part had yet been realised. This year, as he told them last year would be the case, they would, in the ordinary course, have also written off against this fund the two items of preliminary expenses and discounts and stamp duty on debenture stock issued, but the recent telephone arbitration had suggested that it might be unwise entirely to eliminate such items, and consequently, as he was unable to give the matter the careful consideration it deserved, owing to his having been called away to the United States in April, they decided to let these items stand this year with a view to their being dealt with next year, as might then seem best. To the debenture redemption reserve they had this year added £5,257 from profit and loss, plus £618, the discount on the debenture stock redeemed, and they now recommended the appropriation of a further £10,000 to the depreciation reserve, making the joint total £42,995, a figure which he thought they would agree represented a substantial beginning, considering the short time those reserves had been forming; and, in addition, some £1,800 had been set aside during the year for battery maintenance, wiring stocks had been written down by £484, and some other small reserves made in the branch accounts. Without in any way unnecessarily overdoing it, they had every intention of safeguarding the future by the provision of adequate reserves, and, as their prosperity increased, he hoped it might be possible for them to increase still further the amount of the annual provision now made, for, in spite of the fact that it was not always recognised, he maintained most emphatically that the strengthening of the Company's financial position by the provision of adequate reserves was in the real permanent interests of the ordinary shareholders no less than in that of the debenture holders and preference shareholders. Proceeding to refer to the table of lamp connections, the CHAIRMAN said they would be glad to see that they had increased their connections by the equivalent of 87,758 33-watt lamps, an increase of nearly 15 per cent., compared with increases of 9 per cent., 10 per cent., and 12 per cent. in the three previous years. This steady progress constituted a most satisfactory feature, showing as it did the healthy growth and active potentialities of the business. It was true that a large part of the increase, as in the previous year, was attributable to Cornwall, and 72 per cent. of it represented power, but it was all good business, and was not to be despised because it might represent a somewhat smaller proportionate profit than an equal amount of lighting connections. As compared with the previous year, the lighting connections showed an increase of 7 per cent., and power an increase of 26 per cent. The output for the past year increased by 5,494,331 units, from 11,196,157 to 16,690,488, a 49 per cent. increase, for which, as in the case of the lamp connections, Cornwall was principally responsible, the power and heating units representing an increase of 66 per cent., as against a 7 per cent. increase in the lighting units. For the first quarter of the current year, they had connected the equivalent of 14,585 33-watt lamps against 21,804 for the corresponding period last year, when they had an exceptionally large connection in Cornwall. Consequently, of this year's total the lighting connections represented 47 per cent., as against only 16 per cent. a year ago. During the same period the output had increased 47 per cent., the lighting units showing a 5 per cent. increase and the power units a 64 per cent. increase, and these increases were accompanied by a satisfactory growth of profit, so that in spite of the continued high price of coal, he thought they might consider that the outlook was favourable. Referring to the results realised by the individual undertakings, they would see that Newton Abbot continued to show a steady growth of profit, as did also Grantham and Newbury, those three towns being the ones least affected by the increase in the cost of coal, Newbury being a water-power station. Caterham had also done well, and it might be a source of satisfaction to them to notice that the return on the capital invested there was now over 5 per cent., whereas it was little more than 1 per cent. when he joined the board five years ago. The poor results shown by Hawick were principally due to the rise in the price of coal, which, in the case of an undertaking like Hawick with a large power load, was a far more serious matter than in the case of a purely lighting station. Both Weybridge and Twickenham had been adversely affected by dearer coal, and apparently the influence of the metal lamp was still felt in a greater degree there than elsewhere, since in neither case had there been any substantial diminution in the growth of lamp connections, and yet the revenue had not shown a corresponding expansion. Dartmouth had suffered from dearer coal, and also from the adoption of metal lamps by the Naval College, which constituted a large proportion of the load. For the bulk of their increased profit they were indebted to Cornwall, as was only natural in view of the large amount of capital spent there during the last two years; and this profit should again show a large increase for the current year, for he was glad to say the business was developing in the most satisfactory manner, and gave every promise of fully justifying their policy in embarking on it. The only drawback was that it was developing so rapidly and satisfactorily that, to cope with it, they were reluctantly obliged to incur fresh capital expenditure before they had reaped the full benefit from their original expenditure, but it was a purely passing phase, and however inconvenient it might prove to those who were responsible for the raising of the money in these unpropitious times, it was not a matter which need occasion them any anxiety, for they could not well have a better or more direct indication of the prosperity awaiting them. The other towns, Stamford, Godalming, Glossop, and Berwick had all suffered from the effects of dearer coal, and this principally accounted for the poor results shown by them. With reference to the position generally, he did not know that he could usefully add anything to what he had said on previous occasions. From the particulars he had already given them they would have gathered that the business was making steady progress, and everything pointed to its continuing to do so. Without entering into further details, he would content himself by saying that the increased earnings for the current year should more than suffice to pay the increased cash dividend on the preference shares.

MR. FRANCIS E. GRIPPER seconded the motion, and the report was adopted without discussion.

Replying to a vote of thanks, the CHAIRMAN said he hoped the shareholders would stick to their holdings and not throw them away at the present low prices, for he was certain that by holding on they would find the position for all classes improve.

Delhi Electric Tramways and Lighting Co., Ltd.

MR. A. W. TAIT presided on May 29th over the seventh ordinary general meeting of this Company, held at Basildon House, E.C.

In moving the adoption of the report, the CHAIRMAN said that the results for the year 1912 were unsatisfactory, but there had been several contributory causes. The chief causes were the low receipts and high traffic expenses of the tramway system, the abnormal amount of repairs executed owing to the poor condition of the cars and their equipments, and the amount of overhauling which had been necessary to the plant in the Power Station. The year's operations had also been affected by the considerable rise in the cost of coal, which might be emphasised by the fact that fuel expenses for the twelve months under review were nearly as high as the figure for the fourteen months ended December, 1911. The increase in the cost of coal was approximately 20 per cent., and he did not see any prospect of this being reduced in the near future. It was, therefore, all the more necessary for the Company to consider the generation of the whole of the power required by Diesel oil engines, which were much more economical in operation. Owing, however, to the fact that the existing oil engine had to undergo extensive overhaul during the year, the generating costs were adversely affected, and the service of the tramway system was, therefore, on various occasions, interrupted. These interruptions naturally prevented the tramway system from being worked in an economical manner, and this part of the Company's business had shown a loss for the year. They had, however, during the year, done a great deal to improve the condition of the plant and equipment on the tramway system. The Company had also had to contend with the increase in labour rates of all classes, and this rise might be regarded as permanent. Another difficulty had been the low receipts per car mile. A tramway expert who had considerable knowledge of Eastern conditions, and who, at one time, was face to face with the same difficulty and had successfully overcome it, had made an exhaustive report, suggesting drastic changes in fares and traffic conditions, and, after consideration, the Board decided to adopt his recommendations. These had only been in full operation for the last two or three weeks. For sixteen weeks from 1st February, the traffic receipts showed an increase of approximately Rs.15,000, which was equal to about 55 per cent. For the period since 31st December to date, 1,839,000 passengers were carried, as against 708,000 for the corresponding period of last year. This would seem to prove that the tramway system was now catching on with the native population, and they might, therefore, look for a continuation of the increase in receipts. In order to deal efficiently with the traffic under the new conditions, a European traffic superintendent had been appointed. The exceptional expenditure for maintenance would no doubt go on for some time yet, until the system was put into thorough working order. The generating costs for the year were high—due to the increased cost of coal, also to the amount of expense incurred in overhauling and maintenance. It had also been necessary entirely to renew the battery equipment, and they had purchased a condenser, which was now placed in position. It was the hope of the directors that the position of the Company would warrant, in the near future, the installation of further Diesel plant, not only to meet the increased demands which were coming on the system, but also to supersede the existing steam sets, leaving them only as a stand-by in case of breakdown. From recent information received from the Manager, it would seem to be necessary, owing to the growth of the load on the station, to instal further plant at a comparatively early date. The Board had this matter under consideration, and were obtaining competitive tenders for the plant required. With regard to the electric supply undertaking, the gross receipts for the year amounted to £9,136, as compared with £10,360 for the corresponding twelve months of the previous year, which included the special Durbar receipts.

For the four months to 30th April, 1913, as compared with the corresponding four months of the previous year, there was an increase in receipts of over £1,300, equal to over 55 per cent. In addition to the growth of the ordinary lighting demand, the demand for power for small motors continued to grow satisfactorily, and, in order to encourage this still further, the Directors had recently agreed to a reduction in the scheduled rates, which they hoped would attract a considerable number of the small mill-owners in the city. They had also successfully completed negotiations with the Municipality for a new contract for street lighting for a period of five years, which was a considerable extension on the previous contract; and they had also been successful in recently connecting to their mains one or two large institutions which would take a fair supply for lighting and fan work. The number of units which had been generated during the year was 999,347, of which approximately one-half had been sold for lighting and power purposes, the balance being used by the tramway. The average price per unit sold for all purposes was 4.30d.; and the consumers connected during the year amounted to 202, as compared with 157 last year. The total number of consumers at 31st December, 1912, was 887, and, from a cablegram which they had just received from the General Manager, this had now risen to over 1,000. The number of fans which they had connected to their system was 1,059 at 31st December, 1912, as compared with 865 at 31st December, 1911; of which 194 were connected during the financial year as against 162 in the previous financial year. These statistics showed the encouraging progress which had been made by the lighting section. They were also in negotiation with the Government for a supply to their temporary works to the north of the existing city. This supply would, in the first instance, probably be for a period of from 4 to 5 years, although it was impossible to say for what time it would be extended at the expiration of that period. The load was, however, a satisfactory one, and it would enable the Company to reduce considerably the generating costs per unit on the whole system. With regard to the development of the power and lighting station in the new City, it was impossible to give any definite information at the present time. As they knew, the Government experts had made a very close study of the situation, and it was only comparatively recently that they had definitely fixed upon the site for the new City. They were in touch with the officials of the Government—both here and in India—and had received intimation from them that when the Government plans were fully developed, the Company would be asked to tender for the supply. They must, therefore, wait until the scheme was developed, and, when it was received, it would be submitted by them to consulting engineers, in order that they might be advised as to the best and most economical method of carrying out the work and the form of tender which should be sent in. Should the Company be successful in obtaining the concession for the new City and the contract with the Government, this would involve a considerable extension of its capital account. The Company would have to provide for the increasing load on the power station, and a certain amount of capital expenditure would, therefore, be necessary very soon. The Board had the matter under consideration as to the best and most economical manner in which the necessary capital could be raised. He hoped and believed that, to a certain extent, the amount required would be minimised by the profits which should now accrue from the system. It must be the policy of the Board for some little time to come, as profits were made, to retain them in the Company for the purpose of providing for the necessary capital expenditure, which would all tend ultimately to improve results. The affairs of the Company had taken a decided turn for the better, and there was every prospect that its position should slowly but gradually improve. The local board in Delhi was no longer necessary and had been dissolved. It would be better that all matters of administration should be dealt with direct between the London Board and the General Manager in Delhi. In conclusion the CHAIRMAN dealt briefly with the accounts, and also referred to the retirement of COL. SIR BUCHANAN SCOTT from the chairmanship of the Company owing to ill-health, although he retained his seat on the Board.

COL. SIR BUCHANAN SCOTT seconded the motion.

A shareholder pointed out that last year they were told they would be able to obtain some Diesel engines from the Government, but they still appeared to be working by steam. He also understood that another company was going to bring current from some falls near Delhi where it could be generated much cheaper than they could do it, and it was suggested that they should work with the promoters of the scheme.

In reply to this and other speakers, the CHAIRMAN said they were advised locally not to divide up the accounts of the two undertakings. With regard to the new expenditure they had got out certain alternative tenders for plant which would be required to meet their own normal increase, and also the supply to the Northern City. These tenders were on the other side, and until they received them back it was impossible to say what the expenditure would be. He believed that the resources they had, viz., the balance of debentures not yet placed and the profits they were able to make, would enable them to finance that capital expenditure. This was, of course, quite apart from the capital expenditure involved in dealing with the new City of Delhi. They would be very glad to put aside depreciation if they had it. He agreed that the shareholders had had a long time to wait, but they were slowly pulling round. They were like others learning by experience.

The report was adopted, and the retiring directors were re-elected.

Metalite, Ltd.

THE further adjourned ordinary general meeting of the shareholders of the above Company was held on Friday at the offices, Christopher Street, Finsbury, E.C., MR. STEWART (Chairman) presiding.

The CHAIRMAN said he understood that at the last meeting Mr. Bentley presided, and informed them that a Receiver had been appointed by the Bank, and that arrangements had been made by which no sale should take place up to the end of August, to enable the directors to form a scheme of reconstruction. The board had now decided on the general outline of such a scheme, and it had been placed in legal hands, and would be issued to the shareholders he hoped by the end of next week. The new capitalisation of the Company would be nominally £80,000, with £20,000 7 per cent. cumulative preference shares to be issued for cash; a distribution of £20,000 ordinary shares amongst the existing debenture holders and a further £20,000 of 5s. ordinary shares credited with 3s. 6d. paid amongst the existing ordinary shareholders. The present Board would retire, and a new Board would be elected by the shareholders of the new company, for which a special meeting would be called. However, the full scheme would be before the shareholders, and a meeting would be called to consider it, as it was impossible to discuss it that day. He thought they would agree that under the existing unfortunate circumstances it was the best thing that could be devised. He formally moved that the meeting stand adjourned until August 29th, in order that the scheme might be carried into effect.

MR. STONE seconded the motion.

MR. GREGORY asked if August 29th was not too long an adjournment. If they were to assent to any scheme it was important that matters should go quickly.

MR. VINCENT said August 29th was purely an arbitrary date. The shareholders would be notified to attend an extraordinary meeting, and if a scheme was carried through the adjourned meeting would never be held.

MR. GREGORY said he was satisfied with that explanation. He would like to know if it was intended to invite the shareholders to confer with the Board before a scheme was finally drafted.

MR. VINCENT said it was intended to call the ten largest shareholders to a conference.

MR. ANDERSON said that in a public room in Birmingham he heard it stated that the Company had no lamps. Such a statement was calculated to prejudice the Company, and he suggested that in issuing the scheme the Board should give some information about the lamp and its present position.

MR. GREGORY said there was no justification for such a statement.

MR. HARRISON said they could take it from him that the Company had manufactured lamps. He had manufactured many thousands of them.

The motion was then carried.

Electrical Apparatus Co., Ltd.

THE directors' report for the year ended 31st December, 1912, states that the profits (after providing £502 for depreciation and £302 for various items written off) amounted to £5,408 *plus* £132 brought forward. After deducting directors' fees £1,902, works manager's bonus £32, and preference dividend for the year £285, there is available £3,322. It is proposed to deal with this as follows: Dividend of 8 per cent. per annum on the ordinary shares, £1,256; reserve account, £1,000; development risk account, £250; appropriation to workmen's bonus account, £100; writing down patents account to the nominal amount of 1s., £348; writing off the balance of Milford Works account, appearing in balance sheet under New Buildings, £89; writing off the balance of development account, £110; leaving to be carried forward, £169. The rapid expansion of the Company's business has necessitated an extension of the works and offices; new buildings have been erected this year at a cost of upwards of £3,000, giving an additional floor area of over 10,000 square feet. To provide for the larger volume of trade the issued capital was increased from £13,550 to £22,250, and the Board was augmented by the election of Mr. H. R. C. Partridge, who has taken over the works management, and Mr. H. Taylor, who retains the secretaryship. The sum standing to the credit of reserve account on 31st December, 1911, with the further sum set aside out of the profits to that date amounted to £3,000. This has been distributed amongst the ordinary shareholders by the issue of 3,000 fully-paid ordinary shares, being equivalent to a dividend of 37½ per cent. on the ordinary share capital shown in the last balance sheet. The turnover of the Company shows an increase of nearly 60 per cent., and the net profits 66 per cent. over the previous year's trading. This satisfactory result has been contributed to by the higher prices at which the Company's products have been sold during the year under review. A number of new products were developed, from which, however, the Company did not reap any benefit during the year covered by this report, but it is anticipated that considerable improvement will result therefrom in the business for the current year.

Gwynnes, Ltd.—The directors report that the accounts for the year to January 31st, after deducting debenture interest, show a credit balance of profit and loss account of £237.

Edison & Swan United Electric Light Co., Ltd.

THE directors have issued notices to the 4 per cent. first debenture stockholders, and the five per cent. second debenture holders, calling extraordinary general meetings of such stockholders for Wednesday, June 18th, at 12.30 and 2.30 o'clock respectively. The circulars read:—

"The reason for asking your assent to these proposals (see below) is to provide additional working capital for the general purposes of the business. The progress of the Company is being retarded owing to insufficiency of working capital caused mainly by the heavy outlays which it has been necessary to make during the past years in erecting further plant, the expenditure under this heading since 1905 having amounted to upwards of £60,000. The proposals now laid before you, which include the amalgamation of both classes of debenture stock, have been submitted to several of the largest debenture stockholders, and the scheme has met with their approval. You will notice that the Resolutions empower the directors to call up a sum not exceeding £1 per share of the liability now existing upon 99,261 'A' shares of the Company. In return for this the directors propose to hand over to the trustees for the stockholders as further security £25,000 5 per cent. debentures and 33,346 shares of £1 each fully paid, held by the Company in the Altrincham Electric Supply Ltd., and further to raise the rate of interest upon the first debenture stock by ½ per cent., the rate of interest on the second debenture stock being correspondingly reduced. (The circular to the second debentureholders adds at this point: 'but, on the other hand, the second debenture stockholders will have a benefit of ranking *pari passu* with the first debenture stockholders.') In addition, one-third of the profits in each year will be set aside for redemption of debenture stock. The Altrincham Co. is the sole supplier under statutory powers of electric light and power for the town of Altrincham and surrounding district, about eight miles from Manchester; its operations are very successful, as will be seen from the profits made during the last three years, which are as follows:—1910, £4,586; 1911, £4,744; 1912, £5,750. For the current year it is anticipated that they will amount to not less than £7,250."

The following is part of the resolution that will be submitted authorising and agreeing to the arrangement between the Company and holders of the said stocks:—

1. The £313,872 Four per cent. First Debenture Stock of the Company constituted and secured by Trust Deeds dated the 12th January 1897 and the 22nd November 1898 respectively, and now outstanding, and the £135,602 Five per cent. Second Debenture Stock of the Company constituted and secured by trust deeds dated the 19th June 1900 and the 25th November 1909 respectively, and now outstanding, to be consolidated into one stock bearing interest as from the 1st day of July 1913 at 4½ per cent. per annum, and so that the securities respectively constituted by the said Trust Deeds shall henceforth be held by the Trustees for the holders of the said Consolidated Stock for the benefit of all such holders *pari passu* in proportion to the amount of the Consolidated Stock held by them respectively.

2. By way of further security for the payment of the principal moneys, interest and other moneys to become payable in respect of the said Consolidated Stock the Company to charge by way of specific security in favour of the Trustees for the holders of such stock, £25,000 of Debentures and 33,346 Shares of £1 each fully paid of and in the Altrincham Electric Supply Limited, but so that such Trustees may in their discretion permit such a number of the said Shares as shall be necessary to qualify the representives of the Company upon the Board of the Altrincham Electric Supply Limited to remain registered in the names of such representatives for the time being.

3. The Company to covenant with the Trustees for the holders of the said Consolidated Stock that in every year, commencing from the 1st day of July 1913, the Company will apply one-third of the profits of the Company available for the payment of dividends upon the shares of the Company in the redemption of the said Consolidated Stock either by purchase in the market or otherwise at or under par or by drawings at par.

4. Notwithstanding the provisions of the said Trust Deeds and the charges thereby respectively constituted the Company to be at liberty from time to time to call up the capital for the time being uncalled upon the shares of the Company for the time being issued to an extent not exceeding in the aggregate £1 per share, and to apply the moneys so called up for the general purposes of the Company's business.

In the course of a circular addressed to the "A" shareholders, the directors say that they regret the necessity for making a call, but feel that if the business of the company is to be successfully carried on, it is absolutely essential that further working capital be provided, and in their opinion this should have the effect of considerably augmenting the future profits. The call will become payable by intalments not exceeding 5*s.* each, at intervals of not less three months.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Mississippi River Power Co.—Scrip, fully paid, for a further issue of $3,000,000 first mortgage 5 per cent. 40-year gold bonds.

And to allow the following securities to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of $404,000 general mortgage 4½ per cent. 30-year gold bonds of $1,000 each (Nos. 9,362 to 9,765).

Madras Electric Tramways (1904), Ltd.—20,000 6 per cent. cumulative preference shares of £5 each, fully paid (Nos. 1 to 15,000 and 30,001 to 35,000) (renewed special application).

National Telewriter Co., Ltd.—106,989 preferred ordinary shares of £1 each, fully paid (special application).

Underground Electric Railways Co. of London, Ltd.—Further issue of 21,000 shares of £10 each, fully paid (Nos. 7,201 to 8,200 and 26,793 to 46,792).

Consolidated Gas, Electric Light and Power Co. of Baltimore.—The directors have declared a dividend of 1½ per cent. on the common stock for the quarter ending June 30th, being 6 per cent. per annum.

Mackay Companies.—The directors have declared the regular quarterly dividend of 1¼ per cent. on the common shares.

New General Traction Co., Ltd.

THE seventeenth annual general meeting was held on Monday, at the offices, 8, Crosby Square, Bishopsgate, E.C., Baron Emile B. d'Erlanger presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 858), said it would be noticed that the accounts covered a period of eight months only, the previous balance-sheet covering a period of 16 months. In future the accounts would always be made up to March 31st. The balance-sheet was now a very simple affair, due to the fact that they had in the course of the year paid off all the prior lien debentures and the floating debt owed by the company, and they had redeemed £41,700 of the 5 per cent. mortgage debentures, leaving £158,300 still outstanding. Those debentures were now covered over and over again both as regarded capital value and earnings. Since they had now entirely sold the Coventry tramways they had only the following three sources from which they could hope for profit—the American undertaking from which they got a fixed and guaranteed income; the profits from the Douglas Tramway Co., which was a small concern, whose net earnings fluctuated with the weather conditions prevailing during the holiday season; and the large interest they still retained in the Norwich Tramways. It was from the latter source that they could hope to improve the situation either by increasing their profits or by diminishing their expenditure. As to increasing the traffics, they were in the hands of the public—all they could do was to give as good a service as possible. They were, however, in hopes of decreasing the expenditure by improving the generating station. By a capital expenditure of between £3,000 and £4,000 they hoped to be able to make a reduction of some £1,500 or £2,000 in the annual expenditure.

MR. R. J. WEST seconded the motion, and the report was adopted.

Provincial Cinematograph Theatres, Ltd.—Notice of interim dividend of 5 per cent. has been declared, payable on the ordinary shares to shareholders whose names appear on the registers from May 26th.

STOCKS AND SHARES.

Tuesday Evening.

To deal at all adequately with the markets this week a thoroughgoing bear would be required. The ordinary man, seeing the prices dwindle of securities in which he has placed his faith and his money, makes a poor stick to deal with the dismal catalogues of losses shown by all the markets of the Stock Exchange during the past few days. Everybody clamours for a reason that shall explain the fall, but the real cause is too humdrum to satisfy most people. It is too simple a thing for the average men to hear that the stream of new issues is responsible for the greater part of the slump. He demands an explanation of more exciting character, and, to satisfy his appetite, all sorts of rumours are being circulated with reference to this, that, and the other house being in financial straits. Naturally, a prolonged and a heavy fall must have disquieting effects upon the position of houses speculatively inclined, but quite a lot of the reports are manufactured simply in order to meet the demand for them.

Money is in eager demand all over the world. London, Canada, South Africa, Australia, China, Mexico, and the South American Republics are amongst clamant competitors for fresh capital. The ordinary man might well suppose that underwriters could put the brake on new issues if they wished to do so; and it is a matter of astonishment to many people that they do not consider it good policy to set some bounds to the issues which they are prepared to underwrite, knowing full well that the success of them with the public is a dubious matter.

Coming to our own particular departments, most of them show losses more or less substantial in amount. There has been, and is still, a good deal of pressure to sell on the part of people who must have money to meet calls from other directions. This week and last, investment stocks have been coming out in noticeable quantities; and in the House it is becoming more and more difficult to sell what is commonly described as rubbish.

The Home Railway industry is threatened with another strike, an extension of the trouble which originated in the shipping yards. Much bellicose talk characterised the week-end meetings of the men, but, even without this, stocks would probably have gone back. Metropolitans are 2½ down, Districts lost 3, Central London Deferred 2 and the Ordinary stock 1. The slump spread to Underground Electric Railways issues, where the £10 shares in particular were acutely depressed, drooping 10*s.* to 3½. The income bonds fell to 88½, while the other issues also declined. British Electric Tractions have quieted down, though the 6 per cent. Preferred and the Deferred are ½ up at 11½ and 6½ respectively. South Metropolitan Tramways fell back to 1½, partly on a fall in London Suburban Traction shares, these being depressed by statements that a new issue is in contemplation.

Something akin to slump has befallen the Latin-Canadian group. All kinds of inferences are drawn from the violence of the drop, but none are in any way reliable. Brazilian Tractions have lost 4½ points, Mexico Trams 3, British Columbia Railway issues ½ to 2 points, Montreal Light and Power 6½, and so on. The various companies' bonds and Debenture stocks have given way to a lesser degree, the principal decline is 2 points in Mexico Tramway Sixes

In one or two cases the sales appear to have come from stale "bulls" closing their accounts; in others, they are evidently due to pressing need for money, a need the satisfaction of which has led to more or less steep falls in many purely investment securities.

Calcutta Trams, and Anglo-Argentine First Preference, are amongst the few shares which have risen superior to the general tendency of depression. In both cases small advances have occurred.

English Electricity Supply descriptions are, in the words of a dealer in that market, stupid to dull, the last-named being the Stock Exchange way of describing slight depression. This is most noticeable in Charing Cross and City shares, the Ordinary and the City undertaking Preference showing losses of 5s. Counties are also down. Other prices are not quotably altered to any extent worth noticing. Metropolitan 4½ per cent. Debenture stock is again harder. Regret is felt at the way in which the cohesion of the Publicity Committee seems to be in peril, especially considering the vast amount of time, work and thought spent upon it in recent years, and those who follow the matter have been overheard to hope that the threatened schism may be averted even at this eleventh hour.

The scheme for reconstituting the finances of the Edison & Swan Company is an elaborate and rather an involved affair. One of its first consequences was to raise the protest that the proposals formed an attempt to tamper with the security of the proprietors of the First Debenture stock. Following this there came other objections, to meet some, if not all of which, another circular is to be issued by the board. On the first one, some of the shareholders took what was not unnatural alarm, and tried to give away their partly-paid shares for nothing, in order to escape the liability. It may be doubted, however, whether many shares changed hands on this basis. The Second Debenture stock has lost several points.

It is refreshing in these drab markets to be able to write of cheerfulness and better prices in the British Westinghouse trio. The shares are $\frac{1}{16}$ higher; the 4 per cent. Debenture stock has put on 2 points, and the prior lien 1. British Aluminium Ordinary have hardened. Sympathy with the Telegraph market brought down Telegraph Constructions 10s. Castner-Kellners are ½ lower, the shares being quoted *ex*-rights. Rubber shares rallied a little after being uncomfortably flat, but the results of this week's auctions are rather disappointing.

Telegraph descriptions reflect the weakness of other investment markets. Eastern Ordinary is marked down 3, and Eastern Extensions are 10s. lower, for both of which the dividend deductions account. Western Telegraphs lost their recent improvement. Anglo-Americans continue to fall away; West India and Panama First Preference are back to 9¾. Cuba Preference, however, rose 5s., and Direct United States have improved. United River Plate Telephones fell back ⅛.

Marconis, which were $3\frac{15}{16}$ when we last wrote, have been down to 3 since then, from which a rally on bear-covering lifted the price to $3\frac{7}{16}$. Americans dropped to 12s. 6d., Canadians to half-sovereign before support came to brace them up to 14s. and 11s. respectively. In National Telephone Deferred stock there has been little going on, the price remaining about 20¼.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Bath	May 28	4,302	— 123	22	17,792	— 492	..	..
Blackpool-Fleetw'd	,, 31	8,735	+ 327	21	10,115	+ 647	8	..
Bristol	,, 30	33,576	+ 3,798	..	155,634	+ 15,370	30·5	..
‡Brit. Elec. Trac. Co.	,, 23	104,978	+ 12,878	21	483,751	+ 34,951	..	..
Chatham and Dist.	,, 22	3,695	+ 899	20	16,375	+ 660	14·98	..
Cork	,, 29	2,029	— 78	21	9,826	— 230	5·89	..
Dublin	,, 30	24,710	— 518	..	121,788	+ 124	54·25	..
Hastings	,, 29	4,222	+ 548	..	..	+ 993	19·3	..
Lancashire United	,, 28	6,476	+ 682	21	30,295	+ 2,484	89	..
Llandudno-Col. Bay	,, 30	1,508	+ 354	26	5,460	+ 708	6·5	..
London United ..	,, 23	57,771	+1,885	..	118,281	— 1,750	..	..
Tyneside	,, 28	2,105	— 8	22	10,314	+ 416	11	..
Anglo-Argentine ..	,, 27	227,031	+ 20,817	..	1,175,286	+ 92,667	..	..
Auckland	,, 9	21,662	+ 2,808	44	220,978	+ 30,165	24·11	·8
Bombay (B.E.T.) ..	,, 8	13,416	+ 710	18	55,709	+ 2,002	..	..
Brisbane	April	15,390	+ 4,710	17	99,930	+ 36,196	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	June 2	16,225	+ 1,098	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	April	3,078	..	13	11,313	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
†Madras	May 31	1,889	+ 152	..	17,874	+ 1,229	15·25	1
Montevideo ..	May	29,815	+ 3,176	30	239,607	+ 17,176	..	..
Cen. London Rly.	May 31	18,722	+ 1,619	22	114,238	+ 11,249	6·78	·4
City & S. Lon. Rly.	,, 31	10,155	— 1,700	22	63,593	— 5,803	7·26	..
Dublin-Lucan Rly.	,, 30	607	— 97	22	2,770	— 67	7	..
G.N. and City Rly.	,, 24	5,354	— 817	21	30,740	— 4,095	5·5	..
L'pool Overh'd Rly.	,, 25	7,032	+ 698	..	33,886	+ 2,243	6·6	..
London Elec. Ry. Co.	,, 31	58,626	— 905	22	315,400	+ 3,985	21·25	..
Mersey Railway ..	,, 31	8,809	+ 536	22	49,423	+ 8,200	4·5	..
Metropolitan Rly.	,, 25	68,806	+ 1,200	21	344,948	+ 4,844	25·75	..
Met. District Rly.	,, 31	51,859	+ 627	22	288,997	+ 12,109	25	..

* Compared with the corresponding period of 1912.
† Two weeks only.
‡ Includes horse, steam and other receipts.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, June 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£23 5	..
a Lead, Nitrate	,,	£27	..
a ,, White Sugar	,,	£25 5	..
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¾d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a ,, Chlorate	per lb.	3¾d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	82/6	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %) ..	,,	£10 5	..
a ,, Chlorate	per lb.	3¾d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£95	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£112	..
b ,, Sheet, in ton lots ..	,,	£126	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	..
c ,, Tube (brazed)	,,	10d.	¾d. dec.
c ,, ,, (solid drawn) ..	,,	8¾d.	¾d. dec.
c ,, Wire, basis	,,	7½d.	¾d. dec.
c Copper Tubes (brazed)	,,	11⅛d.	⅛d. dec.
c ,, ,, (solid drawn) ..	,,	10⅝d.	⅛d. dec.
g ,, Bars (best selected) ..	per ton	£85	..
g ,, Sheet	,,	£85	..
g ,, Rod	,,	£85	..
d ,, (Electrolytic) Bars	,,	£72 10	£1 5 dec.
d ,, ,, Sheets	,,	£80 10	£1 5 dec.
d ,, ,, Rods	,,	£77 10	£1 5 dec.
d ,, ,, H.C. Wire	per lb.	9½d.	¾d. dec.
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	7/- to 8/-	..
h India-rubber, Para fine	,,	8/8½	1½d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	58/3	9/6 dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£20 to £20 5	£1 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	,,	8/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	¼d. dec.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£213 to £215	£11 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2,8	1d. dec.
p White Anti-friction Metals ..	per ton	£50 to £328	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£27 5s.	£1 15s. dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Prospectus.—*Sir W. G. Armstrong, Whitworth & Co., Ltd.*—This company has been making an issue at par of £1,000,000 5 per cent. non-cumulative second preference shares of £1 each.

William Beardmore & Co., Ltd.—The list closes to-day in an issue of 1,000,000 6 per cent. cum. pref. shares of £1 each, at par, for paying off £866,400 outstanding second mortgage debentures, and for general purposes.

Doulton & Co., Ltd.—The directors' report for 1912 states that after providing £14,000 for debenture interest, and £711 for depreciation of investments, writing £500 off goodwill and deducting the debit balance of £9,782 brought forward, there is a credit balance of revenue account of £13,842, which it is proposed to carry forward.

Mirrlees, Bickerton & Day, Ltd.—At the annual general meeting, held in the Chartered Accountants' Hall, Manchester, on Tuesday last, the directors recommended the payment of a dividend of 7½ per cent. on the ordinary shares and 5½ per cent. on the preference shares, which was approved.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations June 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9⅛ — 10⅛	..	5 18 5
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅜	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10 — 10¾	..	5 12 6
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord...	5	10	10	8⅞ — 9⅜	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8⅝	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97 xd	..	4 2 6
Charing Cross, West End & City	5	5	5†	4 — 4⅛	— ⅛	5 11 1
Do. 4½ % Cum. Pref. ..	5	4½	4½	4 5/16 — 4 7/16	..	4 16 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4	— ¼	5 12 6
Do. Do. 4 % Deb... ..	100	4	4	91½ — 93½	..	4 5 7
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 15 8
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	9	15½ — 17	..	5 5 11
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 7
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 — 102	..	4 8 8
County of London, Ord... ..	10	6	6	10⅜ — 10⅞	— ⅛	5 10 4
Do. 6 % Pref.	10	6	6	11⅛ — 12	— ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104 — 106	..	4 5 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	3/16 — 5/16	— 1/16	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4⅜	..	..
Do. 6% Non-Cum. Pref. ..	5	..	..	1 1/16 — 2 3/16	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7¼ — 7⅞	..	5 16 2
Kensington & Knightsbridge, Ord	5	9	8†	7¼ — 7⅞	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	2½	1¼ — 1⅜	..	4 7 9
Do. 6 % Pref.	5	5	5	4⅜ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 — 102	+1	4 8 8
Do. 3½ % Mort. Deb.	Stock	3½	3½	81 — 84	..	4 3 4
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	101—104	..	4 6 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10⅜	..	5 11 7
Oxford	5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8⅜ — 8⅝	..	5 12 8
Do. 7 % Pref.	5	7	7	6⅜ — 7⅛	..	4 18 8
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
South London, Ord.	4	6	6	2⅞ — 3⅛	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref...	1	7	7	1 3/16 — 1 5/16	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord...	£3	Nil	..	1/4 — 3/4	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅜ — 3 xd	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10	8½ — 8¾	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛	..	4 8 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Calcutta, Ord.	5	8½	8½	6½ — 7½	+ ⅛	5 17 3
Do. 5 % Pref.	5	5	5	5 — 5½	+ ⅛	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	93½ — 95½	..	5 5 3
Canadian Gen. El. Com. ..	$100	7	7	115 —118	—1	5 18 8
Do. 7 % Pref.	$100	7	7	119 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	..	1 1/16 — 1 3/16	..	5 14 3
Do. 5 % Deb.	100	5	5	94 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 7 % Bonds	100	6	6	95 — 97	—1	6 3 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	— ½	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6	3/32 — 5/32	— 1/32	10 13 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100 —102	..	4 18 0
Madras, Ord.	5	Nil	..	1 3/16 — 1 5/16	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	80 — 83	..	5 19 1
Mexican Lt. & Power, Common	$100	4	4†	72 — 75	—1	5 6 8
Do. 7 % Cum. Pref.	$100	7	7	98 —102	..	6 17 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	90 — 92	..	5 8 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	80 — 83	..	5 19 1
Montreal, Lt., H. and Power ..	$100	8	9†	220 —230	—6½	3 18 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5	133 —137	—2	3 13 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	97½—100½	—2	4 9 6
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99 —101	..	4 9 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 95	+1	5 5 3
Victoria Falls Power, Pref. ..	1	11¼d.	17½d.	13/16 — 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4¼†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	131 —134	—1	5 19 5
Do. Collat. Trust	$1000	4	4	92 — 94	..	4 5 1
Anglo-American Telegraph ..	Stock	8	8	61 — 64	—1½	4 13 9
Do. 6 % Pref.	Do.	6	6	109 —110	— ½	5 9 1
Do. Def.	Do.	80/-	30/-	23½— 24	..	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 8
Chili Telephone	5	7	8	7 1/16 — 7 1/8	..	5 1 1
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	84 — 86	— ½	4 13 0
Cuba Telegraph	10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15½ — 16½	+ ½	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3½	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6½ — 7¼	..	6 18 0
Direct United States Cable ..	10	5	4	5⅞ — 6⅛	+ ⅛	6 5 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	129 —132 xd	..	5 6 1
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	75 — 77 xd	..	4 11 0
Do. 4 % Mort. Deb.	Dc.	4	4	90 — 92	..	4 7 0
Eastern Extension	10	7	7	15⅜ — 12⅞ xd	..	5 8 9
Do. 4 % Deb.	Stock	4	4	92 — 94	—1	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	93½ —100½	..	3 11 7
Globe Telegraph and Trust ..	10	6	6†	11¼ — 11⅝	..	5 3 3
Do. 6 % Pref.	10	6	6	12⅜ — 13	..	4 12 4
Great Northern Telegraph ..	10	18	20	30½ — 32½	..	6 3 1
Indo-European Telegraph ..	25	13	13	56 — 58	..	5 12 1
Mackay Companies Common ..	100	5	5	83 — 86	..	5 16 3
Do. 4 % Cum. Pref.	$100	4	4	69 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	20	..	3⅜ — 3⅝	— 1/32	5 18 4
Do. 7.% Cum. Partic. Pref.	1	17	..	2½ — 2⅝	— 1/32	6 3 8
Monte Video Telephone, Ord. ..	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97½ — 98½	— ½	4 11 5
Oriental Telep. and Elec. ..	1	8	10	1⅝ — 1¾	..	5 3 3
Do. 6 % Cum. Pref.	1	6	6	1⅝ — 1¾	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10	10½ — 10¾ xd	..	9 6 0
Submarine Cables Trust ..	Certs.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96⅜ — 98⅜	..	4 11 5
United River Plate Telephone	5	8	8†	6 11/16 — 6 15/16	— ⅛	5 15 4
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16 xd	..	4 7 0
Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	2¾ — 3	..	4 3 4
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¼ — 10	— ½	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¼ — 9¾	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	13⅛ — 13⅝	— ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	92 — 94	—2	4 5 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	—3	4 16 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations June 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil		..	Nil
Do. 5 % Pref.	1	5	5		..	6 8 1
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10⅜ — 12½	+ ⅜	..
Do. Do. Deferred	100	..	..	5⅜ — 7⅜	+ ⅜	..
Do. Do. 6 % Cum. Pr'f	100	6	6	84 — 87	—1	6 17 11
Do. 7 % Non-Cum. Pr'f.	100	..	3	42 — 45	..	6 13 4
Do. 5 % Perp. Deb.	100	5	5	89 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	8	8	81 — 83	—1	‡4 16 5
Do. Pref.	100	4	4	84 — 86	..	‡4 13 0
Do. Def.	100	2	2	78 — 80	—2	‡5 0 0
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	+1	4 17 1
Do. Do. 1896	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1908	100	5	5	97 —100	..	5 0 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2⅝	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	15/32 — 35/64	— 1/32	7 13 7
Do. 4½ % Deb.	100	4½	4½	63 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2⅜	2⅜	2¼ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	73 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 8 4
London United Trams, 5 % Pref.	10	Nil	..	4½ — 5	..	..
Do. 4 % Deb.	100	4	4	62 — 66	..	6 1 3
Metropolitan Railway Consol.	100	1⅝	1⅝	48½ — 49	—2½	3 6 4
Do. Surplus Lands	100	2½	2½	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Pref.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	81 — 83	..	4 4 4
Metropolitan District Ord.	100	Nil	Nil	35¼ — 35¾	—3	Nil
Do. 6 % Deb.	100	6	6	139 —141	..	4 5
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	85 — 87	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	6½	3⅞ — 3¾	..	5 14 7
Do. 5 % Pref.	1	5	5	3¼ — 3⅜	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	87 — 91	..	4 18 11
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	3½	..	3/32 — 3/32	— 1/32	..
Do. 5 % Pref.	1	5	5	3/16 — 3/16	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	6	..	3/32 — 3/32	— 1/16	8 0 0
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	3⅜ — 3⅝	— 1/32	Nil
Do. "A"	1/-	..	..	1/32 — 1/32	— 1/32	Nil
Do. 6% First Cum. Inc. Deb.	100	..	6	109 —111	—1	5 8 1
Do. 4½ % Bonds	100	4½	4½	97 — 99	..	4 10 11
Do. 6 % Income	100	1½	6 †	88 — 89	—3	6 14 10
Yorkshire (West Riding), Ord.	5	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5	3	3†	3/16 — 3/32	..	3 17 5
Do. 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	4⅞ — 5⅛	+1/32	5 7 4
Do. 2nd Pref.	5	5⅛	5⅛	4 13/16 — 4 15/16	..	5 14 3
Do. 4 % Deb.	100	4	4	91¼ — 93½	..	4 5 7
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	96⅛ — 98¼ xd	—1½	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	8	8	10⅜ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	91 —93	—4½	6 9 0
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅜ xd	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛ xd	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	126 —130	—2	6 3 1
Do. Pref. Ord.	100	6	6	109 —113	—1	5 6 2
Do. 5 % Pref.	100	5	5	100 —103	—2	4 17 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	93⅛ — 95½	— ⅛	4 9 0
Calcutta Trams, Ord.	5	7	5†	5⅞ — 6⅛	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	+1/32	4 8 11
Do. 4½ % Deb.	100	4½	4½	97⅛ — 100⅜	..	4 9 7
Cape Electric Trams	1	2½	..	1 1/16 — 1 3/16	..	..
City Buenos Aires Trams (1904)	5	5	5†	5¼ — 5⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	93 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 —101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	+2	5 11 1
Do. 6 % B Deb.	100	6	3	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	7/16 — 9/16	..	..
Do. Pref.	1	6	..	13/16 — 15/16	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1 3/32 — 1 5/32	..	4 9 3
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	103 —105	..	4 15 3
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	100 —102	—3	6 17 3
Do. Gen. Con. 5 % Bonds	..	5	5	88 — 91	—2½	5 9 11
Do. 6 % Bonds	100	6	6	96 — 99	..	6 1 3
Para Elec. Rlys. & Lt., Ord.	5	10	10	6⅞ — 7⅜	..	6 15 7
Do. 6 % Pref.	5	6	6	4¼ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5⅜	1⅜ — 1¾	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅞	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 —102	— ⅛	4 17 7
Do. 5 % Mort. Bonds	100	5	5	92 — 94	—2	5 6 5
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	98 —100 xd	..	5 0 0
Singapore Trams, 5 % Deb.	100	5	5	83½ — 87½	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	6†	5 — 5⅜	..	6 10 3
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	96½ — 98½	..	5 1 6
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3

MANUFACTURING COMPANIES.

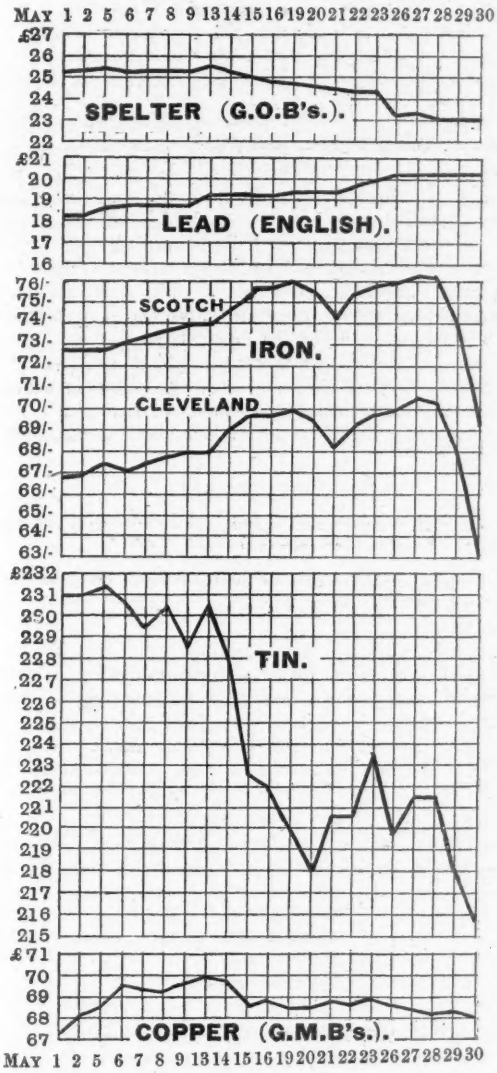
Aron, Ord.	1	6	..	3/16 — 5/16	..	8 0 0
Do. 6 % Pref.	1	6	6	3 — 3⅛	..	7 2 2
Babcock & Wilcox	1	28	16	2 13/16 — 3 1/16	..	5 4 6
Do. Pref.	1	6	6	1½ — 1⅝	..	4 7 3
British Aluminium, Ord.	1	Nil	..	7/8 — 1	+ 1/8	..
Do. 6 % Cum. Pref.	1	Nil	6	3/4 — 7/8	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	99 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5 13/16 — 6 1/16	..	4 14 1
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	3	Nil	Nil	1/16 — 1/8	+ 1/16	Nil
Do. Deb.	100	4	4	67 — 71	+ 2/3	5 12 8
Do. 6 % Prior Lien	100	6	6	99 —102	+1	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	3	Nil	Nil	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	88 — 93	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	25 — 29	..	16 13 4
Callender's Cable	5	15	15	11 — 11⅜	..	6 7 8
Do. Pref.	5	5	5	4 7/16 — 5/8	..	4 17 7
Do. Deb.	100	4½	4½	98 —101	..	4 9 1
Castner-Kellner	1	20	20	3 1/16 — 3 1/8	— ⅛	5 8 5
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	..	1/8 — 3/16	..	Nil
Do. Deb.	100	5	..	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	3/16 — 5/16	..	..
Do. Pref.	1	6	6	5/8 — 3/4	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	1/16 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1/4 — 1 1/2	..	Nil
Do. 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Do. 5 % Second Deb.	100	5	5	65 — 70	—4	7 2 10
Electric Construction	2	2½	3⅜	1 1/16 — 1 1/8	..	5 14 4
Do. Pref.	2	7	7	1 3/4 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	5	6	10 — 10⅜	..	5 11 7
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12⅛ — 18	..	5 15 5
Do. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99⅛ — 101½ xd	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	35 — 37	— ½	6 9 10
Do. Deb.	100	4	4	96 — 99	..	4 0 0
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 57 xd	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guarante by Underground Electric Railways.

Bank rate of Discount 4½ per cent., April 17th, 1913.

METAL MARKET.

Fluctuations in May.



The German Accumulator Industry.—A remarkable conflict of opinion has just arisen regarding the situation of business in the German trade in secondary batteries. As in connection with the Board of Trade in Great Britain, so in the Fatherland there exists a Government official organ which professes to reflect the position of the labour market and of trades at certain intervals. On the present occasion the organ, apparently referring, in the first place, to last year, states that complaints were made of inadequate activity in the manufacture of stationary accumulators, whilst the works engaged on the production of portable batteries were only moderately employed. The decline in the receipt of new orders for stationary batteries, which started in the autumn, continued at the opening of 1913, although this was not entirely surprising, as business in the early months is always quieter. In March and April it is customary for orders to experience a large increase, but in the current year the newspaper declares that the decrease has become accentuated, whilst the call for delivery on old contracts has also abated. The execution of the latter still permits of the maintenance of full working, although a limitation, it is added, will be inevitable in the near future. Although there are various manufacturers of storage batteries in that country, the largest individual firm is the Berlin-Hagen Co., which also exercises, to some extent, a monopoly in the trade, owing to its wide connection with the largest groups of manufacturers, and with the central stations established or promoted by them and their associated interests. This particular company, which brought over into 1913 orders exceeding by £100,000 in value those on the books at the beginning of 1912, recently reported that business continued very active, and that a further development was taking place in the portable battery trade. If then the smaller makers are suffering, according to the official labour organ, it is apparent that the largest undertaking at any rate has no grounds for complaining of the situation of the trade.

REVIEWS.

Metallurgy of Iron and Steel. By MESSRS. SEXTON and PRIMROSE. Manchester: The Scientific Publishing Co. Price 12s. 6d. net.

The subject of the metallurgy of iron and steel is at the present time almost beyond the scope of any one individual. All volumes containing up-to-date information are acceptable, and the present one is especially so, as it is written with undoubted authority. It forms the second edition of a previous work with the same title. Great progress has been made during the last few years in the science of metallurgy, and this book has, therefore, many features of an entirely new work. The authors' aim has been to present a text-book of moderate dimensions for the student, but at the same time to cover the whole field of the metallurgy of iron and steel. A work of this nature cannot possibly gain the approval of every reader, but the authors have made a very careful selection of the more important facts relating to this industry.

The volume begins with a somewhat extensive list of errors, which, for the sake of appearances, might have occupied a less conspicuous position; and, after a quotation from Bacon, the student is introduced to the importance of iron. The first few pages are devoted to introductory remarks on the classification of iron ores. The book is then divided into sections, the first of which deals with the production of pig-iron. This part of the book gives a very clear and interesting account of our present knowledge of the subject. No important facts are omitted, and such vital questions as cost and durability of furnaces receive brief but necessary attention.

Part III treats of malleable iron, and deals with the subject in a very comprehensive manner, especially from the point of view of the English manufacturer. Part IV is devoted to the production of steel, and a considerable amount of space is given up to the important and interesting study of the micro-structure of iron and steel. The authors touch upon the subject of electric steel, but this is disposed of in four pages. We are of opinion that considerably more attention might have been devoted to this section of the book, especially in view of the growing importance of this branch of the industry. Two electric furnaces are illustrated, but neither of these has come into extensive use, whereas other types are now well known. We notice that the appendix contains a diagram of an electric smelting furnace, which has recently been undergoing trials in Sweden.

The book throughout is exceedingly interesting. It is copiously illustrated, both with diagrams and photographs, which, besides giving a fair knowledge of the principles involved, offer some idea of the actual plant in action. The volume teems with useful tables and information, and may be recommended to anyone interested in the subject. Our best thanks are due to the authors for presenting such a useful and valuable compilation compressed into so small a volume.

Electroplating. By W. R. BARCLAY and C. H. HAINSWORTH. London: Edward Arnold. 1912. Price 7s. 6d. net.

This volume, comprising 400 pages, deals with the subject of electroplating in a very comprehensive manner. It is written from the engineering side, and is eminently practical. We must take note, however, that the book is not intended to take the place of practical experience, but rather to supplement the already acquired knowledge of the electroplater. The writers have taken as their basis a course of lectures delivered to students in the technical classes of the University of Sheffield, supplemented by the syllabus in electrometallurgy of the City and Guilds of London Institute.

The volume commences with a chapter on fundamental chemical principles. These are disposed of in a few pages, and will be of very little use to anyone who has no previous knowledge of chemistry.

Following this is a chapter devoted to electrochemical principles, which is very simply and concisely written. The next chapter introduces the electroplater to fundamental

electrical principles. These are very hurriedly disposed of, and will prove somewhat confusing to readers who are not electricians. Then we have the usual theoretical considerations relating to primary and secondary cells and the dynamo. These chapters should prove of considerable interest to the electroplater.

The authors then introduce the real business in hand, namely, the practical side of electroplating. This part of the book is by far the most interesting, and contains a very complete *résumé* of the present known processes of plating. It is well illustrated, and for the most part expressed in language that will commend itself to the class it is written for. Numerous recipes are given which will undoubtedly prove of great value. The theoretical considerations are, as a rule, clearly expressed. There is, however, a tendency to give information whose connection with the theory and practice of electroplating is not at once apparent. We find several passages in the book which are likely to lead to misconception. On p. 249, for example, the idea of catalysis is somewhat confusing, and will probably be misunderstood. The authors further state that recent researches suggest that colloids added to the electrolytic bath move to the cathode. We might point out that this is an actual fact, and not a suggestion, as can easily be demonstrated by the use of the microscope. The subject of electrotypes is touched upon *en passant*, and we consider that this might, with profit, have been considerably elaborated. There is extreme difficulty in gaining accurate information on this latter subject, and more precise knowledge would have been gratefully received.

Throughout the book, simple methods for the analysis of various materials are described. These are perfectly clear, and will not lead to ambiguity. We sincerely hope that this volume will be well received. It deserves the careful consideration, not only of those directly employed in the electroplating industry, but also of those interested in the wider field of electrotechnics.

Applied Electrochemistry. By A. J. Allmand, D.Sc. London: Edward Arnold. 1912. Price 18s. net.

It is a lamentable fact that this country, the birthplace of electrochemistry, falls a long way behind the German Empire in the production of standard literature. Neither country has any great natural facilities for the development of water power, or for the production of cheap electricity, except from coal. In spite of this, however, Germany has taken the lead in the world of electrochemistry, whereas England has fallen considerably behind. There are numerous volumes written in the German language dealing with electrochemical processes, but hardly any in English. Nevertheless, electrochemistry is quietly gaining a firm foothold amongst a certain class of English manufacturers, who are ready to assimilate new facts relating to their technical processes. The present volume is evidently intended to fill their requirements. The author, in his preface, states that he has designed his book for both technical men and students; a laudable ambition, but difficult to fulfil. There is no doubt that the volume will be of immense value to the student. It presents, in book form, facts relating to electrochemical processes which have hitherto been confined to periodical literature.

Dr. Allmand commences his book by a general theoretical introduction, and deals with commercial electrochemistry based on theoretical considerations. A few pages are devoted to the question of power, and the information is of necessity somewhat fragmentary. The reader is then introduced to simple problems of equilibrium, whose general utility is hidden behind involved electrochemical nomenclature. This chapter is quite comprehensible to an advanced student of electrochemistry, but entirely useless to the average technical man. In fact, the chief fault we have to find with the book is the too frequent use of complicated formulæ. The first part of the work deals entirely with the theoretical side of electrochemistry. It is undoubtedly well written, and offers many novel conceptions which have hitherto not been presented in book form.

The second part of the book deals with the commercial side of electrochemistry. There are the usual considerations of primary and secondary cells, treated from the theoretical side. The author then turns his attention to the refining of metals. All the well-known processes are described and diagrammatically illustrated. Electroplating and typing are touched upon and disposed of in a few pages. Other electrochemical industries are dealt with in turn, and described with accuracy. The very interesting work on the fixation of atmospheric nitrogen is ably dealt with at some length; also many other industries which have not been so fortunate as the former in firing public imagination.

It is a pity that working costs are not discussed. To the technical man this is of primary importance. The diagrams are numerous and clear, but give little conception of the actual plant. Greater elaboration would have been useful to the technical man. It is suggested that the book would have been more useful if written in two entirely separate volumes; the first volume treating of the subject from a theoretical standpoint, and the second volume designed exclusively for the technical man. However, it is pleasant to notice that no important electrochemical development has been omitted. The book undoubtedly fills a great need, and is extremely well written and interesting. The thanks of all students of electrochemistry are due to Dr. Allmand for his very interesting addition to our standard electrochemical literature.

Measurement of Induction Shocks. By Ernest G. Martin. 1912. London: Chapman & Hall, Ltd.

This little volume gives a concise account of an improved apparatus for producing standardised electrical stimuli as an aid to physiological research.

The methods adopted by the author are the outcome of observations carried out over a considerable period, during which he became impressed with the necessity of having exact measurements, with a view to obtaining results that could be compared with those of other workers.

The earlier chapters are devoted to an explanation of the conditions affecting the character of Faradic stimuli, an historical review of the progressive steps taken to improve the technique of the work, and a statement of the various requirements necessary for the construction of an ideal apparatus.

The suggestions put forward by the author to overcome the difficulties encountered are extremely ingenious, and apparently the apparatus made in accordance with his ideas gives uniform and satisfactory results.

Full instructions are laid down in connection with the calibration of the instruments, and the mathematical issues involved are clearly dealt with, forming a decidedly unusual feature of electromedical literature.

It is to be feared that the circulation of the book will be limited, as it can only be of direct interest to physiologists, but to such the book will be of undoubted value and, in all probability, it will be instrumental in co-ordinating future work in an important branch of science—important, because physiological knowledge is the basis of medical and surgical procedure.

Handbook of Wireless Telegraphy. By J. Erskine-Murray, D.Sc. London: Crosby Lockwood & Son. Fourth Edition. Price 10s. 6d. net.

Considerable revision and additions to this work are features of the fourth edition, and Dr. Erskine-Murray is certainly to be congratulated on his endeavours to keep the book abreast of progress, and to effect improvements therein. Much new matter has been added, mainly in connection with more recent developments. The description of the Poulsen system is amplified, and the more recent methods and types of apparatus used by the Telefunken Co. are fully considered. The Goldschmidt high-frequency alternator and the Galletti system of transmission also receive attention.

In reference to these latter the descriptions given are very meagre, and it is doubtful whether more than a vague idea of the methods will be conveyed to the student. Taking the case of the Goldschmidt alternator, it is suggested that an explanation of the reactions occurring in low-frequency alternators when the power factor has a very small value would

pave the way for the student to understand the principle involved in the Goldschmidt machine. It could, with advantage, be pointed out how an alternator takes upon itself the functions of a transformer, in addition to those of a generator under certain conditions of working; and how the frequency due to rotation is added to the armature frequency when this transformer effect comes into play.

The high-speed methods and appliances designed for use in connection with the European Poulsen system are adequately illustrated and described. At the end of the book extracts are given from the Marconi Co.'s outline specifications for high-power stations proposed for the Imperial wireless chain.

La Télégraphie sans Fils pour Tous. By F. Duroquier. Paris: E. Orlhac. Price 3 fr.

The author sets out to provide an elementary treatment of the construction and installation of wireless apparatus and the applications of wireless telegraphy. We must congratulate him on his happy knack of spanning wide gulfs, in the theory and developments of apparatus and methods, in such a manner that the discontinuity is hardly noticed, but, at the same time, we believe that few non-technical readers would be able to follow the book. In our opinion, it is admirably suited to the needs of the general electrical engineer who, having read indiscriminately a certain amount of matter dealing with wireless telegraphy, wishes to acquire a good elementary grounding in the subject, either with a view to proceeding to a more advanced study, to enable him to take up amateur wireless work or simply to enable him to read, with greater intelligence and profit, the current "wireless" Press.

In his opening paragraphs, the author sketches the present importance of wireless telegraphy and the general nature of Hertzian waves. The methods of generating and radiating the latter are then considered. When it is stated that Transmission is dealt with in 4½ pages, under the following paragraph headings: Ruhmkorff Coil, Condensers, Interrupters, Transmitting Circuits, Antennæ, Direct and Indirect, Shunt and Inductive Excitation of the Aerial, it will be seen how summarily these matters are dismissed. No explanation is given of most of the technical terms employed, hence the layman is not likely to derive much benefit from the book. On the other hand, a reader grounded in general electrical engineering would gain a good elementary understanding of the subject dealt with. If suitably amplified by lectures, the book should prove useful for students' use.

In Section III, dealing with the reception of Hertzian waves, the Branly and other coherers and relay circuits for use with these are described and illustrated. Various forms of detectors and their advantages in conjunction with telephone receivers are next considered. Surely it is too sweeping a statement to say that crystal detectors are more sensitive than the best electrolytic types? Quite the best printed explanation and distinction which we have seen of and between the telephone sounds produced by damped and musical radiations is given as *cr. crrr* and *tû. tûûûû* (French pronounciation). The author's detector, using a semi-conducting artificial crystal, appears to be highly sensitive, and, by the uniformity of its structure, little subject to derangement; tests have shown it to be eminently suitable for use in field and other sets exposed to rough usage. An explanation of the nature and importance of syntony leads to an explanation and comparison of various arrangements of the receiving circuit. Considering the knowledge assumed in other sections, it seems to be unnecessary to explain the distinction between series and parallel connection on p. 22.

The second part of the work (comprising 20 pages) deals with the construction and installation of wireless apparatus for amateur work. The author is careful to explain that no apparatus, methods, tests or results are described with which he has not had experience and success which can be realised by any reader following the instructions set forth. A station suitable for transmitting messages up to 150 km. is described, but this is rather beyond the needs of the average amateur, and the equipment suggested would certainly be too expensive for the latter. The construction and use of a number of pieces of apparatus—including a convenient ball-interrupter—are explained and clearly illustrated. Some useful suggestions are made as to methods of arranging and suspending the aerial network (often a matter of perplexity to the amateur), and a simple arrangement is described whereby telephone subscribers may use their exchange line as a receiving aerial without in any way affecting the working of the ordinary telephone service. Tuning circuits are described in some detail, and the section concludes with an enumeration of points requiring attention in the maintenance of a wireless equipment.

The third part of the book reviews the present applications of wireless telegraphy, including public service, time signals, weather reports, naval and code messages, Press reports, &c., and sets forth, *inter alia*, the Morse code, a number of station call-ciphers, and the procedure followed in transmitting various signals and reports.

The Appendix includes 14 wiring diagrams, showing the principal arrangements of transmitting and receiving circuits, and commenting briefly on the characteristics and advantages of each. The volume suffers from the defects, common to most French books, of having no index and of being paper bound, but it is certainly to be recommended as a reliable work and a good investment.

BUSINESS METHODS IN NEW ZEALAND.

By WIGWAM.

In some previous notes on electrical matters in New Zealand, we foreshadowed these comments on usual business methods, and in view of difficulties that commonly arise in importing plant and material, we are led to believe that there are a number of English manufacturers who might read them with profit.

It must be borne in mind that the State controls interests in the Dominion that are commonly in the hands of private individuals at home. It not only administers the Public Works, and Posts and Telegraphs, but also the railways, two of the principal coal mines, and its own printing departments. Incidentally, it may be worth mentioning, as showing the extent of such public ownership, that the State runs a Tourist Department, including the administration of the town of Rotorua, which is the centre of the thermal district, a State insurance department, and a number of experimental farms. Recently it has secured control of all the latent water power in the waterfalls and rivers, and has actively commenced to develop it.

To the operations of the Government departments may be added the activities of the municipal bodies, Harbour and River Boards, &c., and together they may be taken to be the purchasers of the great bulk of electrical and mechanical plant, as distinct from agricultural and allied machinery. It will be understood, of course, that such materials as lighting accessories, small motors, and so on, are purchased and installed by private traders and contractors. But, in general, the remarks following may be considered applicable.

Practically all important contracts are publicly advertised, and tenders are invited to a prepared specification. So far, the usual practice in England is followed. Where it differs is in that there are almost invariably the following conditions: First, a deposit has to be paid in when a tender is submitted; secondly, sureties have to be found to guarantee due fulfilment of the conditions if the work is secured.* To these may be added the usual payment for copy, or copies, of specification and drawings, and penalty for delay in completion. The deposit is generally from 2½ to 5 per cent. of the contract price, and has to be made in the form of a marked cheque of an approved bank (the tenderer's own cheque being insufficient); it is held until the contract has been signed by the successful tenderer. Should any hitch occur in settling the final details with the successful firm, the deposit of the next in order of merit, or even of all the remaining firms, may be held, pending settlement, and no payment or allowance is made for bank interest. Thus, on a tender of, say, £30,000 value, a deposit of £750 might be held for weeks, and even months, without acknowledgment of interest due, and when a number of tenders close on

* "Wigwam" is apparently not aware that sureties are often required in this country.—Eds. Elec. Rev.

or about the same date, it will be seen that the total amounts outstanding in that way may be considerable.

The second condition is sometimes even more difficult to deal with. Two sureties are generally to be named, who will together bind themselves in a sum usually of about 10 per cent. of the contract price, for the fulfilment of the contractor's obligations. These sureties are to be approved by the purchasers, and usually the clause is so drafted that it is practically essential to find local men.

Thus the local representative of an English firm is in the position of having to find two bondsmen to back him up on behalf of a firm who may be totally unknown to them. Not only has he, therefore, to add their payment for such bond to his price, but unless his principals guarantee him, he may have to pledge his own property as security. If to these risks is added that of a penalty for delay in delivery or completion, it will be seen that to successfully compete, there must be entire confidence and trust between the local and the home house. It might be argued that the home firm might tender direct, but there are numerous reasons to be urged against this, of which, perhaps, two will suffice.

A firm outside the Dominion, and doing local trade, does not thereby escape the attentions of the income-tax department. The Commissioner of Taxes, in the absence of evidence in the shape of the firm's books, may assess their profit himself, and tax them on his own assessment. The possible result only needs a little contemplation to prove the folly of risking this course.

The second reason is that very frequently the time allowed for completing estimates and making up tenders, does not admit of obtaining detailed prices from home, even if the home firm knew that tenders were being invited.

It will be seen, then, that the position of a local representative endeavouring to open up business, particularly for a home firm whose name is unknown, is not altogether an enviable one, and that he needs not only the friendly assistance but the active co-operation of the home manufacturers. The extent to which this is forthcoming will be largely the measure of their mutual success, or otherwise.

Competition is keen, a fact which many manufacturers do not seem to realise. There is a certain class of British manufacturer who invariably quotes for cash against shipping documents at English port, involving his selling agent in a further expenditure for bank exchange, as well as interest on the value of the goods while they are at sea, *i.e.*, for about two months. He further throws upon the selling agent the risks of making good defects in the material itself, breakages in transit and delays in shipment, or disputes, all of which would appear to be difficulties in which he might reasonably be expected to bear a fair share.

It thus often happens that the local man is unable to agree to some clause in a specification, which involves too much risk to himself in matters over which he has no control, and by striking out such clauses, he places himself at a disadvantage with competitors whose principals support them.

The bank exchange, for instance, where payment is obtained by drawing on a London bank on production of bills of lading, costs about $1\frac{3}{4}$ per cent., a sum quite sufficient on, say, a contract for cables, to put prices out of competition. If payment is made by cheque through the mail on receipt of invoices, the rate can be reduced to about $\frac{1}{4}$ per cent.

It may be argued that the manufacturers equally cannot afford to stand out of the payments for the time the stuff is in transit, but in how many cases of similar contracts made at home would he receive payment in less time?

To turn to other phases of the subject, wherein the makers can materially help their representatives, as has already been said, tenders are often called at short notice, and unless local people have up-to-date prices, it is important that they should be able to obtain them cheaply and accurately by cable—*i.e.*, a complete code system is necessary. Recently there has been introduced a system of deferred cables at half the usual rate per word. They are, however, only transmitted after all the ordinary cables have been put through, no code words or figures are allowed, the message must read intelligently and convey no other meaning than its text implies.

The cost of cabling special points of a specification is heavy, and sometimes the time allowed for completing figures is just sufficient to allow of detailed particulars being sent home by mail and the prices cabled on receipt.

The Customs tariff is often a stumbling block. Suppliers often fail to make the necessary declaration as to the origin of the material on the back of their invoice. British material is admitted at preferential rates, in most things the foreigner being liable to pay 150 per cent. of the home maker.

The duty is assessed on the trade value of the material, plus packing. It occasionally happens that suppliers quote c.i.f. prices, and make out their invoices in the same way. The importer may thus be charged duty on freight and insurance costs included in the total. These should all be shown separately, to save dispute. Quotations should also show both f.o.r. and c.i.f. costs, and give both shipping weight and dimensions, since local railage, wharfage and cartages vary in different districts, and unless the local man has this information, he must either guess the tonnage, or allow extra for contingencies.

The term "Trade value" is the price at which the material is commonly sold to the trade, *i.e.*, list price less discount. If a deduction is shown as commission, this is taken to mean that the deduction is a special one for the benefit of that particular purchaser, and is liable to duty. In assessing the duty, a primage of 10 per cent. is added to the invoice amount; *i.e.*, the duty on £100 worth of goods would be charged on £110.

It is essential to detail all the items that appear on an invoice, and to avoid showing a lump sum for a composite article made up of a number of parts subject to different rates of duty. This particularly applies to electrically driven machines. For instance, machine tools are admitted free, as also are certain classes of mining plant, while cranes and machines generally, other than agricultural plant, are classed as "manufactured articles of metal" liable to duty of 20 per cent. The motors are liable to 10 per cent. only. Insulators are dutiable, whilst the bolts are free. It may be taken that the Customs officials exact the maximum amount to which they can lay claim, and it facilitates matters considerably if manufacturers make out their invoices showing the separate values of each of the items that go to make up the total, and where the different classifications are known, separate invoices should be made out.

It should also be borne in mind that mistakes made either in this connection, or, indeed, in any business transaction, require practically three months to clear up, this being the length of time that usually elapses before a reply is received in course of mail.

The tendency of most public bodies, including Government Departments, is to purchase through local houses rather than through London shippers, as used to be the case, and to hold the local firm responsible.

There is a greater sense of security in having the principal accessible in case of difficulty or dispute, rather than in relying on suppliers who are some 14,000 miles away, and who can only be reached by correspondence.

There can be little question that manufacturers who are represented by thoroughly accredited local houses of good standing and with a working knowledge of the goods to be handled, are those who secure the bulk of the business, and that the most successful combination can only be attained by complete working harmony at home and in the Dominion.

An International Fire Library.—The British Fire Prevention Committee having established a technical library that will be known as the International Fire Library, with a nucleus of over 2,000 books dealing specifically with matters of fire prevention, fire service and fire loss, is desirous of calling the attention of authors, public authorities, publishers and collectors to the fact that a new catalogue is in preparation, and that any books, pamphlets or reports which they are able to spare for this collection should be addressed, as soon as possible, to the Honorary Chief Librarian, The International Fire Library, 8, Waterloo Place, Pall Mall, S.W. The chairman of the Library Committee is Mr. Oswald Wylson, F.R.I.B.A., and the hon. secretary, Mr. D. W. Wood, insurance surveyor. The library, which is the first of its kind anywhere in Europe, promises to be a very complete specialist technical library, and will be made easily available to all primarily concerned in the subject of fire protection.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Scott's Patent Air Compressors.

Messrs. Isaac Storey & Sons, Ltd., of Empress Foundry, Cornbrook, Manchester, have introduced the Scott patent air compressor in which an interesting type of valve is employed. As shown in the part sectional view, fig. 1, the valve consists of two plates and a number of small hardened steel balls. The bottom plate is drilled with a series of holes of two diameters, the top portion slightly larger and the lower portion smaller in diameter than the balls, thus forming a pocket for the ball and a seat for it to rest on. The upper plate is drilled to the same templet as the lower one, and is fixed so that the holes in it are staggered with those in the lower plate, the bars between the holes forming a stop for the lift of the balls. The plates are screwed together, and the valve is thus to all intents end purposes a one-piece device, with positive and rapid opening, large area with small lift ($\frac{1}{16}$ in.), no springs, and small clearance space. The wear is inappreciable, and the valves cannot be broken.

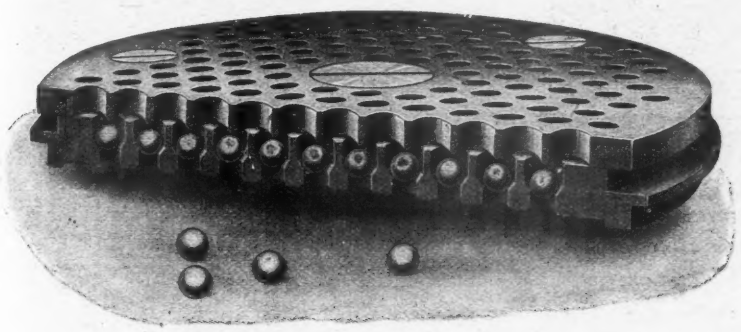


Fig. 1.—Ball Valve for Scott Patent Air Compressor.

The application of the valve is shown in fig. 2, a section of a simple single-crank compressor. The end of the trunk piston is closed with one of the valve plates above described, which approaches almost to touching the fixed valve plate, so that the clearance is exceedingly small. The inlet air passage is cast in the top of the frame, and communicates with the interior of the cylinder through inlet ports round the circumference. The upper end of the cylinder is cooled by a surrounding water jacket containing a large body of water. It will be noticed that the momentum of the balls in the piston valve-plate tends to open and close the valves automatically at the right moment.

The compressors are made of single or double stage type, with one to three cranks, and are designed for driving directly or through gearing by electric motors, as well as by various other means. The air pressure is up to 100 lb., and the maximum capacity 3,000 cb. ft. of free air per minute.

An automatic pneumatic-electric control system has been developed for use with these compressors.

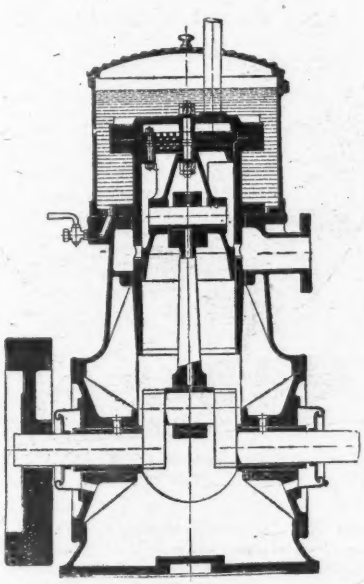


Fig. 2.—Sectional View of Scott Compressor.

The Anger Automatic Brake Adjuster.

An ingenious device which is being marketed at the present time, after a number of years of testing under various conditions in all parts of the world, is the Anger improved automatic brake adjuster.

This device is the invention of Mr. John Edward Anger, the general manager of the United Electric Car Co., and is being placed on the market by the Anger Manufacturing and Supply Co., Ltd., of Preston. The company has factories at Manchester, Paris, Brussels, and is at present arranging for them in Canada and the United States.

The principle of this apparatus is very simple, and it can be applied to any type of truck with any type of platform brake gear.

The question of automatic slack adjustment in brake shoes has of late become quite pertinent, not only in its relation to economies in car maintenance, but in the saving that results from reducing energy consumption and preventing accidents.

Great care and attention should be given to the adjusting of brakes, but this work is often more or less overlooked or neglected, and in most tramways the men appointed to do this kind of work are at the same time called upon for many other duties, with the result that brake adjustment is always more or less attended to in a hurry, and, in many cases, not done with the accuracy that is necessary to give the motorman perfect control of his car.

It is an established fact, and well known to tramway engineers, that the proper place to adjust or take up the slack or wear of the brake shoes is at the point nearest where this is caused, and the Anger adjuster is the only device of its kind that operates on the brake rods, which is the nearest point in the brake equipment to where the slack takes place.

The action of the adjuster is as follows :—

In the application of the brake, the brake lever is drawn outwards, which causes the connecting rod to move the casing in the direction indicated by the arrows, fig. 5. Should the brake lever on the truck be allowed to travel farther than a certain point (owing to the wear of the shoes), the casing which carries the little pawl will travel on the ratchet nut, the pawl engaging with it, and upon the brakes being released and the brake lever returning to its normal off position, the ratchet will be moved forward one tooth and thereby tighten up on the thread on the rod to the amount of the wear that has caused this extra travel of the brake lever. Thus whenever the slack increases so as to allow the brake lever to move the casing a greater angular distance than one tooth, upon its return the slack is automatically taken up, and the winding upon the brake rod is always in one direction ; the ratchets being connected by a top connecting rod, both sides are simultaneously wound up in one direction, and the brake shoes are always kept the proper distance from the wheels until they are worn out.

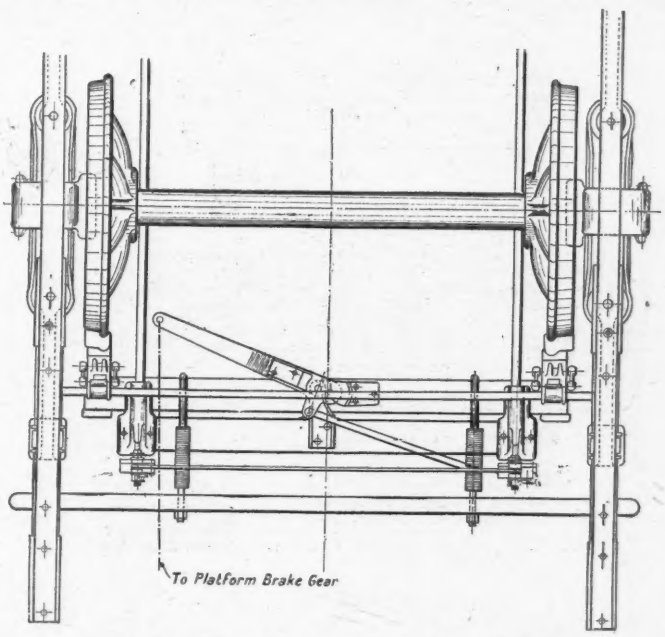


Fig. 3.—Plan View of Anger Brake Adjuster.

It is only necessary to press down the thumb-lever, when the adjuster becomes a simple nut, and unwind it with the wrench, in order to replace the shoes.

The threaded part of this adjuster is made of best phosphor bronze to prevent jamming on the thread, and ensure perfect working and freedom on the rods ; it eliminates the old trouble of having to replace rod ends by cutting them off when the hand nuts

were corroded and jammed on the rod. This device is at the present time in use successfully in over 60 systems in this country, and 75 other systems in all parts of the world, and everywhere we gather that it is giving entire satisfaction.

The company's orders for Corporation systems at the present time include 100 sets for Sheffield, 100 for Birmingham, and 60 for Cardiff, and it has executed its third order for Manchester and its second order for Salford. The device is included in the new specifications for trucks for the Corporations of Sheffield,

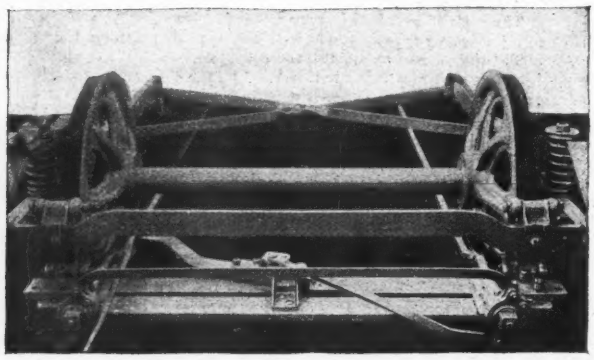


FIG. 4.—ANGER ADJUSTER APPLIED TO STANDARD GAUGE TRUCK.

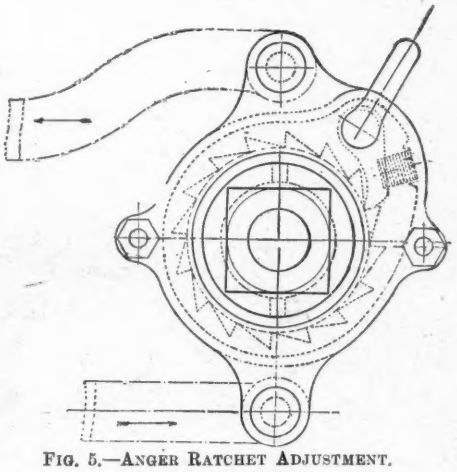


FIG. 5.—ANGER RATCHET ADJUSTMENT.

York, Walthamstow, Santos, East London, Capetown, Ayr, Salford, and many other places.

All of the cars have been recently equipped for the Preston and Blackpool Corporation tramways, and these two systems have placed orders for their bogie trucks as well.

The "Rex" Totally-Enclosed Fuse.

THE GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., have just introduced an enclosed cartridge fuse, in which a number of improvements have been embodied. It is claimed for the "Rex" fuse that it is reliable in operation under the most severe conditions; fuses of one capacity cannot be inserted in bases designed for fuses of another capacity; all metal parts are entirely shielded, rendering it impossible to touch any current-carrying parts when inserting or removing the fuse; and an

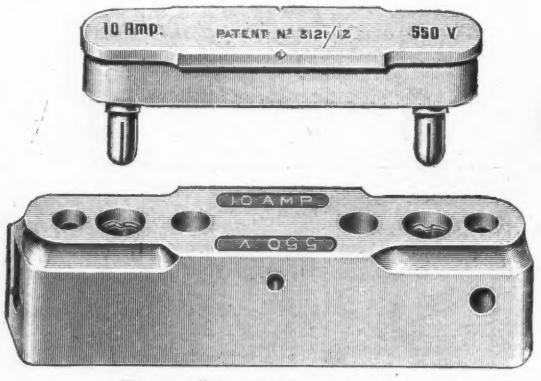


FIG. 6.—"REX" ENCLOSED FUSE.

allowance is made for blown fuses upon their return. The fuse can readily be fitted on existing fuseboards with the ordinary 2½-in. break, and it meets the requirements of the Home Office and Supply Authorities. An indicator shows clearly when the fuse has blown.

Slow-Motion Starting Gear.

MESSRS. H. T. BOOTHROYD, LTD., of Bootle, have brought out a slow-motion gear for operating electric starters and the like (fig. 7). It consists of a special worm and wheel device arranged to be double automatic in any position of the starter arm, and also arranged so that the arm cannot be moved until the main switch is closed, or left in any position other than the "full on" position.

The arm is fixed to the hub of the worm wheel, whilst the rim of the wheel is loose on the hub, and the worm can drive the rim round the hub so long as there is no connection between the two. The connection is provided by a coil—the no-volt coil—which is energised in the usual way, and which operates an armature carrying a toggle and pawl, the latter engaging with teeth cast on the inside rim of the loose worm wheel. The worm handle carries two contacts connected to the terminals of the no-volt coil, and these contacts are closed (thereby short-circuiting the coil) until they are opened by pressure of the hand on the turning handle, thus removing the short circuit, and so allowing the coil to be energised, and the hub of the worm wheel to be picked up by the rim clutch.

On removing the hand from the handle, the two contacts referred to close again, and the no-volt coil is shorted and the hub is released from the rim and returned by a spring to the "off" position. The starter is retained in the "full on" position by destroying the short circuit across the no-volt coil when the hand is released. This is done by introducing into one of the leads from the handle to the no-volt coil terminal, a pair of contacts arranged so as to be open-circuited by the arm in the "full-on" position only. Thus when the arm is in the "full-on" position, it is immaterial whether the hand is removed from the handle or not, because there is a break introduced into the short-circuiting circuit as described above. The no-volt coil is also short-circuited in the usual way by the operation of the overload release.

The object of the device is to make the gear automatic and quite independent of the operator for returning to the "off" position, either due to overload or failure of the supply. The operator is not able to leave the starter in any intermediate position, but only in the "full-on" position. The gear is also certain in its action; it does not rely entirely upon a strong magnetic pull for keeping the

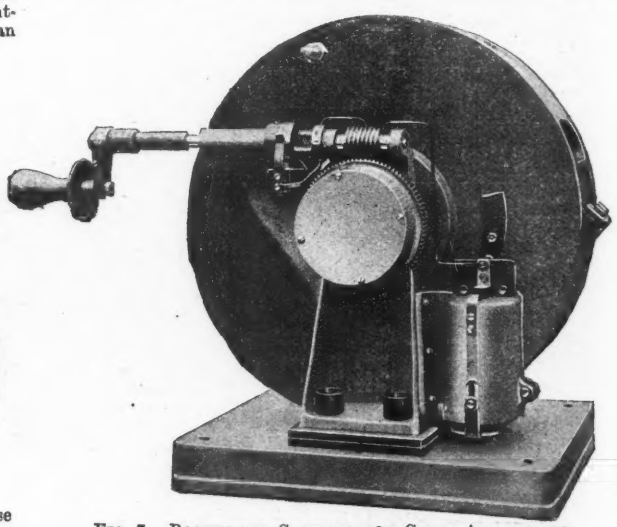


FIG. 7.—BOOTHROYD SLOW-MOTION GEAR, APPLIED TO WOOLLISCROFT LIQUID STARTER.

catch in position, as this is accomplished by a toggle arrangement, which requires very little magnetic energy to retain the pawl in action, and thus it is able to use a very small no-volt coil, which is usually not in service with the field circuit. Also, with this type of gear the operator is able to rotate the switch to the "full-on" position, or bring it from the "full-on" position gradually to the "off" position, which is very useful for slowing-down motors for putting on belts, &c., when it is not required to stop the machine entirely. The worm and worm-gear are always in mesh, and one hand only is required for operating the starting gear.

Low-Water Alarm and Feed Regulator.

MESSRS. O. ELLEFSEN & CO., of 26A, Silver Street, Bradford, have brought out a new patent low-water alarm and feed regulator of very ingenious design.

A copper tube is attached to the boiler shell, projecting into the interior, and carries at the further end a lever at right-angles to its axis. The lever carries at one end a bucket, and at the other a counter-weight. The inner end of the tube is closed, and is supported by a sling from the boiler shell. Within the tube is a steel rod, fastened to the inner end and projecting through the boiler shell at the base of the tube; the free end of the rod carries

part of a switch, which closes an electric circuit when the rod rotates.

The bucket is open at the top, and is normally immersed in the water; when the level of the water falls, the weight of the full bucket at the end of the lever exerts a torque upon the end of the tube, which is thus slightly twisted, and the steel rod within it actuates the switch, closing the circuit and ringing a bell, or by means of a relay starting a motor which drives the feed pump. When the water is restored to the proper level the circuit is broken.

The system presents the advantages that the inside of the boiler is completely sealed; there are no sliding or rotating joints, which are apt to stick or leak, and at the best offer a great deal of friction; and the movement is obtained through the flexibility of

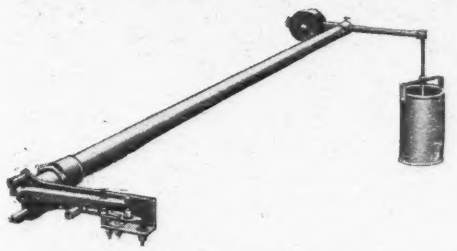


FIG. 8.—ELECTRIC LOW-WATER ALARM.

a tube, which is not likely to vary with time. There is no electrical connection to the boiler. The apparatus can be employed to start a steam pump, or to operate the feed valve if several boilers are fed from the same pump. It is, of course, applicable to other vessels besides boilers.

Vulcanwax.

A new wax for insulating and impregnating cables and wires has been introduced by MESSRS. WERTHS & CO, of 41, Aldersgate Street, E.C., under the above title. It is a rubber-like product, highly resistant to weather and to water, acids, &c., with a high electrical resistance, and can be vulcanised. It can be melted, becoming fluid at 75° C., for impregnating braiding, &c., and forms a smooth coating on the cable, which is not sticky in hot weather or brittle in winter, nor does it smear when handled.

PROCEEDINGS OF INSTITUTIONS.

Royal Institution Discourse and Exhibition.

AT a meeting of the Royal Institution, on May 23rd, Prof. S. P. Thompson delivered an interesting discourse on "The Secret of the Permanent Magnet." The lecturer remarked that artificial magnets had long since replaced the lodestone for practical purposes but, although it was known before the Christian era that iron was magnetic and could be magnetised, it was even to-day unknown why iron and steel could be magnetised to so much greater an extent than any other materials. Much progress had been made, however, during recent years, in elucidating the actual process of magnetising iron, and in determining the conditions essential to the manufacture of a good permanent magnet. About 150 years ago, many English investigators were engaged in magnetic researches and English magnets had a world-wide reputation. Unfortunately, much of our prestige in this field had been lost, and the further study of the causes of permanence in magnets was undoubtedly a legitimate commercial and scientific problem, to which greater attention should be paid in this country.

By breaking up and testing the fragments of a hack saw and by the well-known tube-of-filings experiment, the lecturer justified the hypothesis that magnetisation depended on the orientation of the particles of the material concerned. The sound of a bar being magnetised and demagnetised was clearly heard all over the auditorium; the increasing length of an iron bar when magnetised was demonstrated simply and effectively, and the orientation of the particles in an emulsion of lodestone, when subjected to a magnetising field, was beautifully illustrated by showing that light could then pass through the "cohered" emulsion, parallel to the direction of magnetisation of the suspended particles.

The genesis of the hysteresis loop was explained, and Dr. Thompson showed that from the magnet-maker's standpoint, the important section of the curve was that reproduced in fig. 1 herewith, in which O R was a measure of the remanent magnetism, *i.e.*, of the retentivity of the iron, while O C expressed the coercivity or fixidity of the magnetisation. Madame Curie had found that 0·06 per cent. and 1·2 per cent. carbon steels had roughly equal retentivity, but the coercivity was negligible in the former and high in the latter case. The famous Allevard (Savoy) steel—made from a material which was no good as iron—was known to be a splendid magnet material for years before the cause was determined. Analysis showed that this steel contained 5·5 per cent. tungsten, and it had since been discovered that tungsten, vanadium, molybdenum, nickel and chromium all gave magnetically valuable alloy steels. Manganese steel, on the other hand, was practically non-magnetic. At the present time, a remanence of 800-900 and a fixidity of 50-60 in carbon and 70-80 in special steels could be obtained, and the lecturer believed that the time would soon come when his ideal magnet iron, with a remanence of 1,000 and a fixidity of 100, would be manufactured commercially. The self-demagnetisation coefficient of a magnet could be expressed by the angle α, fig. 1, the height D P representing the actual "permanent" retentivity of the material. By demagnetising the steel somewhat (from P to M, fig. 1), the retentivity would be reduced to E Q, but the fixidity would be increased to E C, hence the "letting down" by prolonged "seasoning" of magnets in steam or boiling water was to be recommended strongly. Inspection of their hysteresis loops showed that Remy steel was best for short and Böhler steel best for long or nearly closed magnets. The form of magnet most favourable to permanence was the horseshoe with closely adjacent poles. Lantern slides showing micro-photographs of etched steel sections

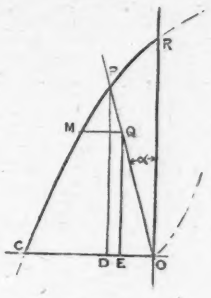


FIG. 1.

were exhibited, and it was explained that a fine granular structure was best for permanent magnets (as would be expected from Ewing's hypothesis). Summarised, the secrets of making good permanent magnets were:—The use of tungsten steel; the shaping of the metal to a nearly closed magnetic circuit; the forging of the metal at as low a temperature as possible; the heating of the steel above the temperature of recalescence; its quenching while in the non-magnetic state; and finally the prolonged seasoning of the magnetised metal. The actual magnetisation was the least important of all the operations involved. The great problem yet to be solved was why iron and steel could be magnetised at all.

At the conclusion of the lecture, the working of Poulsen's telegraphone was demonstrated. Among the exhibits in the library, Messrs. R. Paul showed a wide range of "Unipivot" instruments, for simple electrical measurements, insulation and bridge tests or use in conjunction with thermo-couples, as well as Campbell's vibration and bifilar galvanometers and an inductometer bridge and other instruments. Messrs. Everett, Edgcumbe exhibited portable photometers, a reverse A.C. relay; power factor and frequency meters; charge and phase indicators. The phase indicator, comprising essentially a small three-phase motor, is most useful in avoiding incorrect connections in phase meters, &c., where the sequence of the phase connections is important. Messrs. George Cussons & Son showed a novel form of Atwood's machine and other interesting mechanical apparatus, and Dr. W. Rosenhain exhibited some fine etched steel sections. A number of firms showed permanent magnets of all kinds. The Cambridge Scientific Instrument Co. exhibited the Grassot fluxmeter and search coils, and Mr. F. J. Mudford illustrated the practical application of the magnetic method of determining hardening temperatures for steel. The CO_2 Thermoscope, shown by the Underfeed Stoker Co. should do much to popularise flue gas analysis and the scientific control of boiler working.

Prices Charged for Electric Power.

By SIDNEY SIMPSON, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Leeds and Sheffield, April*, 1913.)

THE position of an undertaking from the commercial standpoint is gauged by the balance available after meeting all debts and liabilities in respect of capital expenditure, working expenses and depreciation.

A review of the returns of many electrical supply undertakings throughout the country would indicate that in comparison with most industries an adequate and true profit on capital invested is not being made.

Whether the working capital be obtained in the form of a loan, to be repaid with interest within a fixed number of years, or from the issue of debenture stock, mortgages, preference and ordinary shares, when the time arrives that the plant, mains, buildings and apparatus require renewal, or have ceased to have an economical productive value, then the loan covering this amount or the capital originally expended should have been redeemed, and interest on outstanding money paid annually out of the receipts from the undertaking.

Of the loan repayment and depreciation periods, whichever be the shorter period, this liability should be met by an annual charge on the undertaking before any true profits can be taken out of the

business. Unless adequate provision is made, a time must arrive when, owing to some of the plant, mains and apparatus having become wholly obsolete, an amount will have to be debited to profit and loss account, which should in strictness have been borne by previous years.

There is the certainty of deterioration, and always the risk of obsolescence, even though kept in good repair. The estimate of the period of useful life therefore can only, after all, be an estimate. Very seldom does plant, &c., wear out or become obsolete exactly in the way anticipated.

The method of dealing with depreciation in which a fixed percentage is taken annually out of receipts to write off the original outlay within a fixed period, paying at the same time interest on the outstanding amount, appears to be the soundest method; repairs and renewals as necessary being made a separate charge to revenue accounts. An average depreciation or writting-off of the capital account within 15 years should be allowed for.

An analysis is made of the published returns for the year ending March, 1912, and appearing in the *Electrical Times*. This is divided as follows:—Table A, covering 21 local authorities of more than 15 years' working. Table B, covering 33 local authorities of 15 years or less working; each with 2,000 KW. or more of plant, and with total capital costs per KW. of plant, £60 or less.

The amortisation of the capital account on a 15-year basis to bear 3½ per cent. interest on outstanding principal is taken as an annual charge per £100 of capital expended of £9 14s. This figure covers depreciation and minimum interest, to this amount must, therefore, be added working expenses, set against revenue account before contingencies and true profit can be arrived at.

On this basis the results, as summarised below, are most unsatisfactory. However, since a few undertakings show a substantial profit, the soundness of the basis taken is, I think, confirmed:—

	From Table A.	*From Table B.*
Years working	16 to 28 years	7 to 15 years
Total capital cost per KW.... ...	£48 75	£42
Per cent. revenue to capital ...	14·6 %	16 %
Working costs per cent. of revenue	45 %	53·8 %
Load factor (based on maximum demand).	11·55 % to 25·16 %	13·9 % to 29·4 %
Standing charge per unit sold ...	·823d.	·663d.
Works cost per unit sold	·617d.	·665d.
Total net production costs per unit sold.	1·44d.	1·328d.
Average price obtained	1·375d.	1·23d.
Present loss per unit	·065d.	·098d.
Loss as % of revenue	4·75 %	8·05 %

A consideration of these results indicates that an increase in price is necessary to bring about financial stability.

The tariffs as set forward below would appear to meet the respective cases, and to form the basis of a scale of charges which would meet the capital and working costs involved. The questions of contingencies and profit are eliminated.

Table A.—Total capital cost per KW. = £48·75. This written off in 15 years at 3½ per cent. interest = £4·27 as a standing charge per annum per KW. of plant in commission—*i.e.*, £6·05 as a standing charge per KW. of plant installed. The average works costs = ·617d. per unit sold, and assume this on 20 per cent. load factor of station plant.

We then have:—Standing charge £6·05 per KW. of maximum demand + works costs per unit sold, based on load factor of use of supply, or:—

	Per unit.
For 20 % load factor supply use a charge =	·823 + ·617 = 1·44d.
„ 10 % „ „ „ =	1·646 + ·812 = 2·458d.
„ 40 % „ „ „ =	·4165 + ·447 = ·8635d.

Table B.—Total capital cost per KW. = £48·75. This written off in 15 years at 3½ per cent. interest = £3·65 as standing charge per annum per KW. of plant in commission—*i.e.*, £4·85 as standing charge per KW. of plant installed.

The average works costs = ·665d. per unit sold.

We then have:—Standing charge £4·85 per KW. of maximum demand + works costs per unit sold, based on load factor of use of supply, or:—

	Per unit.
For 20 % load factor supply use a charge =	·663 + ·665 = 1·328d.
„ 10 % „ „ „ =	1·326 + ·845 = 2·171d.
„ 40 % „ „ „ =	·3315 + ·482 = ·8135d.

Present prices charged for supply of load factors up to 10 per cent. are, generally speaking, remunerative, and the losses are made on the supply at higher load factors—in other words, on the industrial power supply. Unless the charge be based on these lines all round equity is not obtained, and the tariff on these lines appears to be the only basis on which capital expenditure is justified.

It is suggested that accounts should be subject to revision—say, annually—with regard to the following points effecting the tariff:—

Diversity.—This factor varies from time to time, being greater, the greater the variety of industries served.

Power Factor of Load.—The effect of low power factor to choke the revenue-bearing property of the capital outlay. In order that the importance of this fact may be brought to the notice of the consumer, it is necessary that he should contribute his proportion of the extra charges involved.

A minimum payment equivalent to half the estimated total revenue should be enforced in order that the tariff shall be equitable. Not only is it necessary to cover the standing charges of the plant, but the establishment charges have to be met whether units be taken or not.

The efficiency of consumers' working capital and the result of putting money saved on power plant down in productive machinery does not appear to have had the proper consideration and use as a very real argument, that it might have had.

Whereas £100, if put into the power plant yields 5 per cent. interest, if put into the business instead, for productive plant, it yields 5 per cent. and 7 per cent.

The inherent advantages of the electric drive are becoming more and more realised, and it is up to the supply undertakings to insist on them when negotiating business.

Discussion at Leeds.

Mr. T. Roles said that no doubt the author had based his figures on a general principle of all-round equity to all types of consumers, but he (Mr. Roles) held that it was impossible to get that. The only basis upon which they could hope to run a supply undertaking was in a general way to aim at charging every class of consumer at a price somewhere in the near neighbourhood of the cost at which he could, in the alternative, supply himself. If they wanted to get a large power user, they would probably have to charge him in the neighbourhood of ⅜d. or ·4d.; and in his judgment it was absolutely necessary to get the large power user. If the amount of returns from a mill was sufficient to pay the capital charges on a main and transformer station, they could make their profit on the lighting consumers.

Mr. H. H. Wright was inclined to agree with Mr. Simpson that where profits had been made at all they had been made on the small consumers, and he contended that the losses which were recorded by Mr. Simpson were due to the low prices charged to the larger consumers. The actual cost of driving a weaving mill with steam, including everything that ought by any possibility to be taken into account, was 18s. 10d. per loom per year of 2,730 hours, or 4½d. per week. Upon a carefully prepared estimate of the cost of electric driving he arrived at a cost of 50s. per loom per year, or 1s. per week.

Dr. R. Pohl said he thought there must be fundamental mistakes at the bottom of both the author's and Mr. Wright's conclusions. Mr. Wright had assumed the maintenance of the maximum load right through, whereas he thought the average load would be considerably less. In the second place, if they had a shed of about 100 looms those would not all be running at the same time. There would be a diversity factor that might be anything between 60 and 75 per cent., and that had not been taken into account. Mr. Simpson's mistake seemed to lie in the standing charge per unit sold, which Mr. Simpson calculated at a depreciation rate which wiped out all the capital in 15 years, and which at the same time included 3½ per cent. on the capital standing in the books at any given time. Surely they did not propose to depreciate the entire site value in 15 years; the greater probability was that the site value would appreciate. Fifteen years might be all right for the life of generating plant, but the depreciation was surely altogether excessive on buildings and mains, the latter of which accounted for quite 50 per cent. of the capital as a rule. Altogether, he considered that the figures for standing charges were quite excessive, and that was sufficient to explain the extraordinary result according to which practically every central station in the kingdom was losing money continually. If they were to accept Mr. Simpson's suggestions as to charge for maximum demand, they would not get a single power consumer, and would, in effect, be definitely declaring themselves bankrupt. He agreed with Mr. Simpson that, to a large extent, they made the lighting consumer pay for the large power consumer, and that was the way in which the supply authorities managed to make a profit, as he contended they did. Instead of increase of prices, he would suggest a very considerable reduction of the lighting rates, so that the cooking and heating load would increase rapidly, as well as the lighting load. He fully believed that, if they took their courage in both hands in that matter, the demand would increase at such a rate that there would be no risk of having to increase power charges.

Mr. E. S. Rayner said he was anxious for information as to how to tackle the power load question, because Doncaster was now a centre of very rapid development, and he did not see how it was to be done satisfactorily. How could they compete with a firm putting down their own plant in the case of a place which wanted 1,000,000 or 2,000,000 units per annum?

Mr. Schofield agreed with Mr. Simpson's figures. He thought that Mr. Wright had made a mistake somewhere in his cost of electric drive in a weaving shed, because a loom of the kind referred to had been found by actual tests to consume about 10 units per week, and at a ½d. per unit, that was only 5d. instead of a 1s.

Mr. J. C. B. Ingleby said he was particularly struck with the low revenue of the supply authorities, compared with the amount of capital embarked. Any business should, surely, at least turn over its capital once a year. The only way to do this was to increase the load-factor, and reduce the capital costs, and not touch the prices at all, or, if anything, reduce them.

Mr. H. Brown agreed that any increase of prices would be very difficult, and thought that the only thing to do was to increase the load factor, and keep prices as they were.

Mr. Simpson, in reply, defended his theory of charging the various classes of consumers on principles of equity, and argued the matter out, at some length, with Mr. Roles.

DISCUSSION AT SHEFFIELD.

MR. H. E. YERBURY objected that the author's period of 15 years for repayment of capital was too short, and did not bear a correct relation to actual experience. In their last Parliamentary Bill in Sheffield, for instance, they obtained a 20 years' period for power stations and cables. The really equitable method of charging appeared to him to be for each consumer to pay a sufficient sum to cover standing charges on the plant required for his purposes, plus a charge based on works cost and a reasonable percentage of profit. Then as the output for any station increased the customers would get the benefit of the increase by way of the lowering of the proportion of the works costs charged. The great difficulty about the proposition for an increase of prices was that in proportion as these were put up inducements would be offered to manufacturers to install their own generating plant. Low-priced energy was one of the means of attracting new undertakings to a city for the benefit of the ratepayers.

MR. H. A. NEVILLE said that if Mr. Simpson's 15 years' proposition meant that he would equate all loans and pay them out in 15 years, he could not agree to it at all. The principle of equated loans seemed to him to be absolutely wrong. The only equitable basis for repayment of loans was to take each section of the works and plant at its own determined life or at a reasonable estimate of its life, and reckon a varied period of repayment for each section. He differed from Mr. Simpson in regard to his suggestion that the lighting consumer was being charged a high price in order to make up for the low price charged for power. When they took into consideration the load factors, it was easily seen that the long-hour consumer at a low price was a much more profitable consumer than the short-hour consumer at a high price.

MR. W. N. Y. KING also defended the position of the larger consumers who, he thought, ought to be credited with a good deal of the economy on the running costs, as well as on the capital costs, and he agreed with Mr. Yerbury that in municipal supply there should be no question of profit, but merely a desire to produce energy as cheaply as possible in order to assist and stimulate productive industries.

MR. J. C. B. INGLEBY urged the importance of cutting down capital expenditure, and said he thought that the most expedient way to do that would be by having rather less expensive buildings and a more economical management of the laying of mains. If they could reduce the capital expenditure by a reasonable amount most of the undertakings dealt with in Mr. Simpson's tables would be made to show a working profit. They could not, in his opinion, increase the charges for electricity.

MR. E. J. MARSH pointed out that in Sheffield they had to compete with gas supplied at 11d. per 1,000, which, of course, meant a very low power figure. He thought, too, that a mistake was made in having too many systems of charging for electricity. A simple system was what the consumer required. If he had the choice of 30 different systems he would never be satisfied that he had selected the right system for himself.

MR. SCHOFIELD said he entirely agreed with the wisdom of the 15 years' period for repayment, and thought that they should consider, not so much what they could get in the way of prices, as what was profitable.

MR. W. E. BURNAND said that in regard to capital expenditure, he was always struck by the very large amount of plant that had to be kept up for the sake of a load which only came on for a very few hours in the year. This plant was really out of all proportion to the amount of income from it. In Sheffield the spare plant to meet the needs of a peak load, which was used not more than five hours a year, represented 8,000 KW.

The CHAIRMAN (Mr. W. B. Woodhouse) said he was afraid there was only one ideal system of charging, and that was on the simple principle of the highwayman who demanded: "How much money have you got?"

MR. SIMPSON, reverting to the Leeds discussion, held that the final effect of Mr. Wright's contrast of steam and electric driving costs was that by the use of electricity in such a case £4,800 would be saved on capital account, and with that money the manufacturers would be able to put in 160 more looms, and that meant an increase of profit of about £760 per annum, in addition to which there must be considered the additional advantages of the speeding-up of the drive and the extra output, which would result from the steadier running. As to his 15 years' period, he adopted it as a conservative figure, which was hardly likely to be on the wrong side, though time alone would show that. As to his grading of the tariff, unless it was done on some such lines, they could not justify capital expenditure. There was this to be remembered in regard to the loan period, that whatever the loan periods were it was the actual life of the plant which determined the soundness or unsoundness of the depreciation basis.

Recent Developments in the Street Lighting of Manchester.

By S. L. PEARCE, M.I.E.E., AND H. A. RATCLIFFE, M.I.E.E.

(*For abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *see our issue of March 21st*, 1913.)

DISCUSSION AT GLASGOW.

MR. R. D. MITCHELL (Glasgow) said the authors referred to lowering gears rather to their detriment. He, personally, emphatically endorsed the conclusion come to at the recent London conference, that lowering gear made a great saving. In Glasgow they had not only gone in for flame lamps with lowering gear, but for magnetically operated switches with control from a central point. Where flame arc lamps were substituted for ordinary arc lamps, it was almost necessary to adopt these appliances owing to the greatly increased cost of carbons with flame lamps. Economies had to be got in other directions, so that the total cost might not be seriously affected. Lighting authorities in general were quite willing to accept the greatly increased illumination, but they were not willing to pay more—at any rate, not very much more—for the change. It was by automatic switching, long-hour lamps and lowering gear that these economies might be effected. In Glasgow they had 837 arc lamps now, nearly all flame arc lamps, and they were busy fitting the last 100 lowering gears. When the electric control was first put into use, the trimming staff numbered 23 men. This change enabled them to reduce the number to 11. With the long-hour magazine lamps and lowering gear, a further reduction to four regular men and one spare man would be brought about. Each man attended to 62 lamps per day, and no Sunday work was necessary. In the summer, out of the four men, two could be taken off the lamps to do overhauling in the shop. The switching was done by the inspectors, who, after switching on, set out on bicycles to do their rounds, each taking one-half of the city. All the lamps were switched on in five minutes. He considered that in connection with any new scheme of street arc lighting electric control should be taken into account. The control cable was laid at small expense along with the arc leads. His experience was that the candle-power of high-pressure gas lamps did fall off 50 per cent., and that quickly. He had found in high-pressure gas lamps in Glasgow streets, a falling-off of about 33⅓ per cent. in one week's time, the first reading being 3,200 C.P. at 20°, second reading 2,200 C.P. at 50°, and less than 2,000 C.P. at 20°. He saw it remarked by the authors that the use of clear globes was objectionable, due to the glare causing eye strain. He did not think there was glare to that extent. Even when the globes were quite clear the light appeared to emanate from the whole surface of the inner globe, more intense, of course, but the arc itself should not be taken as the source. Clear globes with lower surfaces only obscured were inevitable, in his opinion, in view of the competition to be faced. The gas people never thought of using anything else, glare or no glare. With reference to the experiments made with dioptric globes, it was stated in the paper that the tremendous intensive heat was due to the open lower end of the globes. No doubt that was so, but did the authors not find also by using dioptric globes with open lower ends that the fumes from the carbons condensed on the cold surface of the outer globe, and in a very short time obscured it? Some experimental lamps in Glasgow had shown this effect after having been in place for two weeks.

MR. ALEX. WILSON (general manager, Glasgow Corporation gas department) said the authors stated that the electric lighting possessed all the practical advantages. As to lower cost, he agreed that in Manchester they might be quite right; the arc lighting there had been taken in hand in a scientific way. The reason for the difference between the state of affairs in Manchester and in London was the excessive gas leakage which was shown to have existed in Manchester. With regard to the simplicity of switching operations and the possibility of dispensing with lamplighters, they in Glasgow had a large proportion of lamps where the switching was done automatically, and automatic switching could be carried out in any way desired. As to the C.P. of the lamps in Manchester, the efficiency of these was far too low. They had had a great deal of trouble in Glasgow in getting the lamps adjusted, but having done that, they got an efficiency of, say, 60 candles per cb. ft. He noticed that the outlay was very heavy; the actual cost was about £30 a lamp, and for gas £48. In Glasgow they would want four or five lamps for that.

MR. J. A. ROBERTSON (Greenock) said he believed that in the Westminster lighting district the maximum candle-power to be obtained was specified as to be taken at 20° and 45° from the horizontal. It seemed to him, looking at the curves, that it would be a comparatively easy thing to get at the result by using a proper globe, so that the specification which called for a particular candle-power at a given angle was upon the basis of what they wanted. So far as lowering gear was concerned, he could understand difficulties arising with types of gas lamps, but it was exactly here that electricity had the advantage. His belief was that they should always try to get an illuminant approaching nearest to daylight. They were rushing to extremes in high candle-power for street lighting, and when that was taken in conjunction with the illumination caused by shop-keepers and at picture palace frontages, there was sure to be a reaction, if for nothing else than for the safety of the public.

MR. S. LONGLANDS (inspector of lighting to Glasgow T.C.) expressed himself as not altogether favourable to lighting tests on the streets, for many matters had to be taken into consideration where they had a mixture of grey, white and red stone buildings. He thought in every case the laboratory test was best. At present his department was equipping a laboratory for this purpose, so that it might stand in perfect fairness right between the gas and electricity departments.

MR. PEARCE, in the course of his reply, said he quite appreciated the value of the economies which could be obtained by using raising and lowering gear, but those who knew the conditions in two typical Manchester streets would appreciate their position. He was, however, open to conviction on the general question of fixing lamps, and, if they had future extensions in Manchester, they would consider the question of traversing and lowering gear. A point which weighed with them in this connection was the extreme difficulty of getting the necessary permission from property owners for attaching the gear to the walls of buildings. In connection with the depreciation of gas mantles, he thought street trading

had a great deal to do with that, to say nothing of heavy vehicular traffic. In both those respects Manchester was a very bad city, and in one of the districts referred to in the paper the change from gas to electricity was made because of that. Gas leakage was inevitable, and he admitted that in Manchester it was excessive. As to the efficiency of Manchester lamps, it seemed to him that if they wanted to get up to the neighbourhood of 50 candles per cb. ft., it must be got by gradually increasing the pressure and renewing mantles more frequently at the expense of maintenance. The general point of the paper was that, assuming electricity cost twice as much as it was stated to cost in the paper, or assuming that the gas lamps were twice as efficient as given, the result was in favour of electricity. As to uniform lighting, that was frequently obtained at a cost out of all proportion to the advantage resulting from it.

Mr. Ratcliffe also briefly replied.

PATENTS EXPIRING IN 1913.

(*Continued from page* 920.)

7,427. "Rotary converters." J. Imray. (Soc. Anonyme pour la Transmission de la Force par l'Electricité.) April 8th.—Relates to a converter or transformer for converting simple or alternating currents. Two armatures, preferably Gramme rings, are mounted on one shaft. The one ring rotates within an inductor of an asynchronous motor supplied with alternating current. The other ring rotates between field magnets in the polar extensions of which are fitted rings connected by copper bars.

7,525. "Submarine telegraphy." A. Muirhead. April 10th.—Relates to arrangements in connection with submarine telegraphy for transmitting, receiving and translating either in single or duplex working. The specification describes a number of modifications for obviating a shifting zero, employing and regulating curb currents, and the use of "outflow" and "overflow" circuits in connection with the artificial line for regulating and sharpening the signals in translating from one circuit to another.

7,892. "Electric batteries." E. W. Jungner. April 14th.—Relates to both primary and secondary batteries, and consists in the use of an electrolyte which remains unchanged during the charging and discharging of the battery, except that its solvent water is separated from it. Potassium and sodium hydrates are examples of such electrolytes. The plates or electrodes consist of insoluble oxides of metals or finely-divided metals.

8,228. "Electricity measuring." G. C. Fraser and G. K. B. Elphinstone. April 19th.—A portable apparatus for measuring the currents necessary to fire primers, and given by firing batteries, and for testing the condition of primers; it consists of a dead-beat ammeter, connected in series with a key and a variable resistance between two terminals in a case; two other terminals, connected together, are also provided.

8,961. "Telegraph and telephone recording apparatus." V. Poulsen. April 28th.—Relates to means for recording and reproducing messages, such as telegraphic or telephonic messages, by means of an electromagnet acting upon or being acted upon by a magnetisable wire or strip. A cylinder is covered with a close spiral of steel wire, which is to take the place of the phonographic plastic cylinder, and an electromagnet is mounted in a sliding carriage to take the place of the stylus. The carriage is mounted on a rotating tubular frame, and is provided with a centrifugal lever, which brings the core of the magnet against the wire while the frame is rotating. The removal or obliteration of the messages from the strips is obtained by traversing the wire, &c., with a magnet carrying a steady continuous current. (A petition for extending this patent has been filed, but the result is still pending.)

9,882. "Lighting railway, &c., vehicles." E. J. Preston and A. B. Gill. May 10th.—Relates to improvements in train, &c., lighting. A switching arrangement for controlling the number of lights is used. The current is supplied from a battery or other source, and the lamps are divided into two sets connected to a switch consisting of two drums engaging with contacts. The spindle carrying the drums is rotated by electromagnetic means controlled by a switch. The contact faces on the drums are so arranged that one or both sets of lamps may be alight or both may be extinguished.

13,509. "Cranes." J. G. W. Aldridge. June 29th.—In electric cranes, the switch handle is connected by links to the clutch for the hoisting-drum, so that, as the motor is started, the drum is automatically and simultaneously geared with the motor-shaft. The descent of the load is regulated by a hand or other brake.

13,561. "Electric motors." M. J. Barreau. June 30th.—Relates to a construction of electric motors, designed to secure maximum efficiency, notwithstanding variations in speed, especially applicable to electric traction, but also applicable to navigation and transmission of motive power. The windings of the induction coils are divided into sections, and by means of a rotary controlling-switch these sections are variously connected into sets or groups, while the battery cells are similarly grouped, in order to give the variations of speed desired.

(To be continued.)

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,551. "Ratchet and pawl free-wheel driving pulleys fitted to dynamo used for electrically lighting motor-cars." O. Bird. May 19th.

11,553. "Method of and means for protecting and supporting pipes, tubes, conduits and the like when exposed to furnace flames or subject to other high temperature." R. C. Lyness. May 19th.

11,560. "System of enumerating telephone calls and apparatus therefor." S. D. Williams. May 19th.

11,561. "Mariners' compasses of the projector type." Kelvin and J. White, Ltd., and M. B. Field. May 19th.

11,579. "Selector arrangement for several stations lying on a common line." K. Beckmann and Akt. Ges. Mix & Genest. May 19th. (Complete.)

11,590. "Graded service automatic or semi-automatic telephone system." H. Baron. (G. Heiman, Germany.) (Addition to 11,261/12.) May 19th. (Complete.)

11,609. "Telephony." S. G. Brown. May 19th.

11,623. "Electrically operated or controlled valve." E. C. Irving and J. P. O'Donnell. May 19th.

11,629. "Trolleys for electric traction systems." E. M. Munro and R.E.T. Construction Co., Ltd. May 19th.

11,630. "Circuit arrangements for telephone systems." Siemens & Halske Akt. Ges. (Convention date, May 25th, 1912, Germany.) May 23rd.

11,634. "Process for the electrolysis and treatment of sulphate liquors." E. J. Hunt and W. T. Gidden. May 19th.

11,657. "Protective device for electric distributing systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 19th.

11,658. "Electrical control clocks for trunk line switchboards." Aktiebolaget L. M. Ericsson & Co. (Convention date, May 21st, 1912, Sweden.) May 19th. (Complete.)

11,673. "Incandescent electric lamps." C. W. Read. May 20th.

11,674. "Electrical method of burning lime." G. C. Goodman. May 20th.

11,677. "Electric heating and cooking apparatus." E. W. Lancaster. May 20th.

11,678. "Electric heating and cooking apparatus." E. W. Lancaster. May 20th.

11,704. "Arc lamps." H. E. Moul. (Korting & Mathieson Akt.-Ges., Germany.) May 20th. (Complete.)

11,715. "Electrically-operated mechanism for advertising and other purposes." J. R. Bell, jun. May 20th.

11,737. "Spark plugs." L. J. Dirand. (Convention date, October 29th, 1912, United States.) May 20th. (Complete.)

11,750. "Apparatus for the production of alkali metals by the molten electrolysis of alkali compounds." G. W. Johnson. (Deutsche Gold und Silber Scheide Anstalt vorm. Rossler, Germany.) (Addition to 1,933, 1913.) May 20th. (Complete.)

11,751. "Electrical relays." J. H. Baker and A. E. McKechnie. May 20th.

11,791. "Cramp belts adaptable as electro contact cramps and the like." J. S. Romanes. May 21st.

11,835. "Electricity meters." Compagnie Internationale d'Electricite Soc. Anon. (Convention date, May 31st, 1911, Germany.) May 21st. (Complete.)

11,833. "Wireless telegraphy." H. L. Short, A. E. Short and H. O. Short. May 21st.

11,850. "Electric cut-outs with multiple safety fuses." R. Despessailles. (Convention date, March 31st, 1913, Belgium.) May 21st. (Complete.)

11,852. "Electrostatic apparatus for separating and cleaning grits, grains, seeds or the like." J. Kraus. (Convention date, April 30th, 1913, Germany.) May 21st. (Complete.)

11,858. "Electric safety-lamps for use in mines and other places." T. Harrison and A. Strong Frazer. May 21st.

11,860. "Electrical equipment of motor vehicles." H. Leitner. May 21st.

11,871. "Electrolysis of aqueous solutions." Soc. of Chemical Industry in Basle. (Convention date, December 9th, 1912, Germany.) May 21st. (Complete.)

11,886. "Commutators." C. Zenk. (Convention date, May 21st, 1912, United States.) May 21st. (Complete.)

11,888. "Automatic or semi-automatic graded service telephone system." H. Baron. (G. Heimann, Germany.) May 21st. (Complete.)

11,896. "Electric water heaters or the like." R. Weaving and Ferranti, Ltd. May 21st.

11,905. "Means of equalising or balancing electric currents, applicable to rotary converters or other dynamo-electric machines." A. H. Railing and C. C. Garrard. May 22nd.

11,930. "Construction of electrical hot-plates, boiler rings, and the like." C. R. Belling. May 22nd.

11,945. "Contact make-and-break devices adapted for use in wireless telegraphy and for other purposes." L. B. Turner. May 22nd.

11,960. "Electrical connectors of the plug and socket type." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Pegg. May 22nd.

11,970. "Illuminated signs." J. G. A. Tetart and M. J. Staerck. May 22nd.

11,972. "Automatic ships' telegraph alarms." J. A. Sullivan. May 22nd. (Complete.)

11,975. "Production of electrical resistance materials." Resisto-Electrical Manufacturing Co., Ltd., and C. Ruzicka. May 22nd. (Complete.)

11,990. "Electric ignition generators." B. Lawrence. (Addition to 14,324 and 21,582, 1912.) May 22nd. (Complete.)

11,993. "Urns, or the like, for heating water by electricity." J. Mann. May 22nd.

11,997. "Chemical, electrochemical and electric treatment of plants, fields, seeds, crops or the like." R. Mies. May 22nd. (Complete.)

11,998. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) May 22nd. (Complete.)

12,001. "Igniters." E. C. Jones and J. Pearson. May 22nd.

12,035. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) (Addition to 13,970/12.) May 23rd. (Complete.)

12,054. "Incandescent electric lamps." C. A. Harrison. May 23rd.

12,060. "Telephone systems." Siemens & Halske-Akt.-Ges. (Convention date, May 25th, 1912, Germany.) May 23rd. (Complete.)

12,061. "Trolleys for electric traction systems." E. M. Munro and R.E.T. Construction Co., Ltd. May 19th.

12,065. "Electric welding." E. H. Jones. May 23rd.

12,074. "Oscillation spark gaps." W. T. Ditcham and Grindell-Matthews Wireless Telephone Syndicate, Ltd. May 23rd.

12,075. "Microphones for use in wireless telephony." W. T. Ditcham and Grindell-Matthews Wireless Telephone Syndicate, Ltd. May 23rd.

12,076. "Apparatus for use in wireless telephony." W. T. Ditcham and Grindell-Matthews Wireless Telephone Syndicate, Ltd. May 23rd.

12,082. "Arc lamps." H. Ayrton. May 23rd.

12,100. "Multiple way indicators." T. G. Hodgkinson. May 23rd. (Complete.)

12,115. "Fittings for metallic conduit systems for housing electrical conductors, specially applicable to ceiling rose fittings and the like." Simplex Conduits, Ltd., and L. M. Waterhouse. May 24th.

12,129. "Apparatus for heating liquids electrically." British Electric Heater Co., Ltd., and C. Kratt. May 24th.

12,157. "Switching arrangements for use in wireless telephony and wireless telegraphy." W. T. Ditcham and Grindell-Matthews Wireless Telephone Syndicate, Ltd. May 24th.

12,162. "Telephone systems." Automatic Telephone Manufacturing Co. Ltd. (Automatic Electric Co., United States.) May 24th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Arc Lamp Electrodes. British Thomson-Houston Co., Ltd. (General Electric Co.) 18,689. August 14th.

Controlling or Regulating Devices for Electric Lamps. E. Johnson. 22,127. September 28th.

Wall-plugs for Electrical Fittings. F. Scheinig. 23,582. October 15th. (October 16th, 1911.)